

DOCUMENT A00801

SPECIAL PROVISIONS**CHELSEA****Construction of the Silverline Gateway Busway,
BRT Stations and Bridge Replacement (Steel) Br. No. C-09-001
Washington Avenue over the MBTA Railroad**

Labor participation goals for this project shall be 15.3% for minorities and 6.9% for women for each job category. The goals are applicable to both contractor's and subcontractor's on-site construction workforce. Refer to document 00820 for details.

SCOPE OF WORK

All work under this contract shall be done in conformance with the Massachusetts Highway Department *Standard Specifications for Highways and Bridges* dated 1988, the *Supplemental Specifications* dated June 15, 2012, and the *Interim Supplemental Specifications* contained in this book; the *2012 Construction Standard Details*, the *1990 Standard Drawings for Signs and Supports*; the *2009 Manual on Uniform Traffic Control Devices (MUTCD)* with *Massachusetts Amendments* and the *Standard Municipal Traffic Code*; the *1968 Standard Drawings for Traffic Signals and Highway Lighting*; the latest edition of *American Standard for Nursery Stock*; *ARCHITECTURAL ACCESS BOARD (521 CMR 1.00 et. seq.)* and *MassDOT Highway Division's Engineering Directive E-97-008 dated 10/09/97*, the latest edition of the MassDOT Bridge manual, the Plans and these Special Provisions.

The work to be done under this contract consists of constructing the Silver Line Gateway project along a MassDOT and MBTA owned right-of-way, including an abandoned section of the former Grand Junction Railroad, between Everett Avenue and Eastern Avenue in the City of Chelsea.

The work includes, but is not limited to, construction of a 1.2-mile long dedicated busway, Bus Rapid Transit (BRT) Stations, a Shared Use Path, upgrades to existing railroad grade crossings, and replacement of the Washington Avenue Bridge over MBTA Railroad and Silver Line Busway (Bridge No. C-09-001).

Work along the Busway will consist of removal of existing pavements, concrete, tracks, and wood railroad ties, construction of new asphalt and concrete pavements, installation of granite curbing and edging, partial reconstruction of railroad grade crossings including relocation of gate arms, drainage improvements, retaining walls, lighting, landscaping, bio-retention swales, guard rail and barrier installation, milling and resurfacing pavements, construction of cement concrete sidewalks, signing, pavement markings and the provision of safety controls and signing for construction operations and other incidental items included in the contract document, and other work incidental to the items herein necessary to complete the work, as shown on the contract drawings, as specified herein, and as directed by the Engineer.

SCOPE OF WORK (Continued)

The work includes construction of new BRT Stations including concrete platforms, canopies, shelters, signage systems, lighting, way-finding signage, security and communications systems. Work at the BRT Stations will be performed in accordance with MBTA Standard Specification as modified herein under Document A00803 - Appendix A of these Special Provisions.

The Washington Avenue Bridge Replacement includes replacing the existing 2-span bridge with a longer 2-span bridge to accommodate the proposed Busway. Work includes demolition and disposal of the existing bridge superstructure and the partial removal of the existing bridge substructure; the construction of a new two-span structure utilizing twelve (12) steel rolled W12 beams with an 8" cast-in-place concrete deck with a 3" superpave wearing surface supported on modified north abutment, and new center pier and south abutment founded on spread footings as shown on the Plans. The work shall be completed in two stages.

The Bidders attention is also directed to the Track & Signal Systems Work of this project. Bidders must be prequalified by the MBTA for the Trackwork and Signal Systems in the following Classes of Work: CLASS I – GENERAL TRANSIT CONSTRUCTION; CLASS 2 – GRADING DRAINAGE & SITE DEVELOPMENT; CLASS 3 – TRACKAGE; and CLASS 6A – TRANSIT/RAILROAD SIGNALING.

The Trackwork and Signals Systems Work will consist of improvements to the existing tracks and signal systems at Spruce Street on the East Route Line to support the construction of the Silver Line busway. The work includes but not limited to, track construction, grade crossing rehabilitation, removal of automatic signal locations, track surfacing & alignment, and the retirement or demolition of existing track and signal system elements. These improvements will be made while the existing East Route Commuter Rail Line maintains revenue passenger and freight service except for select weekend service shutdowns. The Trackwork and Signals Systems Work shall be done in accordance with the MBTA Construction Specifications For Bus Rapid Transit Station Construction attached as Document A00803 - Appendix A, MBTA Construction Specifications For Railroad Grade Crossing Reconstruction Work attached as A00804 - Appendix B, *the Railroad Operations Commuter Rail Material Specifications, the Railroad Operations Directorate Specifications Guidelines, the Commuter Rail Design Standards Manual Volume 1 Section 1 – Track and Roadway, the Commuter Rail Book of Standard Plans Track and Roadway Section 1, the Commuter Rail Book of Standard Plans Track and Roadway Section 2* and the Plans (Volume 3) and Division I and Division IA of these Special Provisions.

SEQUENCE OF WORK

Before starting any work under this Contract that affects traffic, and at least seven (7) days in advance of beginning work, the Contractor shall prepare and submit to the Engineer for approval a plan that indicates the traffic routing proposed by the Contractor during the various stages and time periods of the work, and the temporary barricades, signs, drums and other traffic control devices to be employed during each stage and time period of the work to maintain traffic and access to abutting properties including adjacent businesses. Particular care should be taken to establish and maintain methods and procedures that will not create unnecessary or unusual hazards to public safety.

CONTRACT AWARD AND NOTICE TO PROCEED PROCEDURES

(Amending and Supplementing Subsections 3.03 and 3.05)

The prepared Contract package which will be e-mailed the day following the bid opening is to be completed in duplicate by the successful Bidder who shall execute and deliver the Contract package and furnish the required surety to the Department on the third day after the date of bid opening by 2:00 pm. For this project the date of contract will be the Wednesday of the week following the date of bid opening (i.e. generally eight days after the bid opening) and this date of contract will be typed on all forms by MassDOT.

The company's corporate seal should be affixed to both the contract and bonds.

The Contract Package consists of the following documents all of which must be returned:

- Contract Page (Two Originals)
- Performance Bond (Two Originals) (Power Of Attorney should be in the return package)
- Payment Bond (Two Originals) (Power Of Attorney should be in the return package)
- Statement Of State Tax Compliance (Two Originals)
- Certificate Of Compliance With Massachusetts Employment Security Law (Two Originals)
- Board Of Directors Vote (Two Originals)
- Certification Of Contractor (Two Originals)
- Certificates Of Insurance (Two Originals)
- Insurer's Affidavit For Worker's Compensation (Two Originals)
- Out Of State Certificate (If incorporated outside of Massachusetts) (Two Originals)
- Certification Of Construction Equipment Standard Compliance Requirements (Two Originals)
- Diesel Retrofit Data (Two Originals)
- Executive Order 481 – Contractor Certification (Two Originals)

These documents are on the CD as a separate file.

The board of director's vote will indicate who is authorized to sign and execute the contract and bonds and affix the corporate seal. The vote shall show that said vote is in full force and effect and has not been amended or rescinded. The vote of the board of directors should be dated the same date as indicated on the contract form and should bear the imprint of the company's corporate seal.

PROCEDURE FOR RELEASING AUTOCAD FILES TO THE GENERAL CONTRACTOR

After the bid opening the low bidder may submit the Request for Release of MassDOT AutoCAD Files Form to the Highway Design Engineer. When the Highway Design Section has received both the AutoCAD files from the designer and the Request for Release of MassDOT AutoCAD Files Form from the Contractor, Highway Design will email the contractor a link through Dropbox.com with a reminder disclaimer of use (copy to Project Manager and District Construction Engineer).

CONTRACTOR QUESTIONS AND ADDENDUM ACKNOWLEDGEMENTS

Prospective bidders are required to submit all questions to the Construction Contracts Engineer by 1:00 P.M. on the Thursday before the scheduled bid opening date. Any questions received after this time will not be considered for review by the Department.

Contractors should email questions and addendum acknowledgements to the following email address massdot-specifications@dot.state.ma.us. Please put the MassDOT project file number and municipality in the subject line.

ENGINEERING DIRECTIVES

Contractors can access MassDOT, Highway Division Engineering Directives at:

<http://www.mass.gov/massdot/highway>

Select Doing business with us

Select Design/Engineering

Select Engineering & Policy Directives

Select Engineering Directives

CONTRACTOR/SUBCONTRACTOR CERTIFICATION – CONTRACT COMPLIANCE

(Revision 03-23-10)

Pursuant to 23 C.F.R. § 633.101 et seq., the Federal Highway Administration requires each contractor to “insert in each subcontract, except as excluded by law or regulation, the required contract provisions contained in Form FHWA-1273 and further requires their inclusion in any lower tier subcontract that may in turn be made. The required contract provisions of Form FHWA-1273 shall not be incorporated by reference in any case. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the requirements contained in the provisions of Form FHWA-1273.” The prime contractor shall therefore comply with the reporting and certification requirements provided in MassDOT’s CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form (DOT-DIST-192) certifying compliance with 23 C.F.R. § 633.101 for each subcontract agreement entered into by the contractor. The contractor shall provide a fully executed original copy of said CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form to MassDOT upon execution of any subcontract agreement. Failure to comply with the reporting and certification requirement of the CONTRACTOR/SUBCONTRACTOR CERTIFICATION Form may result in action against the prequalification status of the prime contractor with MassDOT.

SUBSECTION 4.04 CHANGED CONDITIONS

This Subsection is revised by deleting the two sequential paragraphs near the end that begin “The Contractor shall be estopped...” and “Any unit item price determined ...” (1/6/2006)

NEW INTRODUCTIONS OF INVASIVE PLANTS INTO OR AROUND THE SITE

(Supplementing Subsections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property)

The Contractor shall ensure that no invasive plant species, as defined and listed by the Massachusetts Invasive Plant Advisory Group, are introduced or moved around the site by construction activities either by improperly cleaned construction equipment or importation of infected materials such as borrow, compost, nursery stock, seed, or hay bales. Corrective measures, if necessary, shall be made by the Contractor as directed by the Engineer.

The Contractor shall be solely responsible for all costs associated with ensuring that invasive species are not introduced or moved around the site by construction activities and for all corrective measures required for as long as necessary to eliminate the introduced invasive plant species and prevent re-establishment of same. Item 102.3 includes compensation for site assessment to determine pre-construction presence of invasive plants as well as methods of control.

WORK SCHEDULE (Supplementing Subsection 8.02 and replacing Subsection 7.09 paragraph 12 from the 2012 Supplemental Specifications)

Work on this project is not restricted to a normal eight-hour day, five-day week with the Prime Contractor and all Subcontractors (with Prime Contractor oversight) working on the same shift. The Contractor will be allowed to work an extended shift from 3:30 P.M. to 7:00 P.M. with the approval of the Engineer. Work may be permitted for longer shifts beyond 7:00 P.M., or during pre-approved times on Saturdays and Sundays, with the approval of the District Construction Office. Work performed outside of the normal Monday through Friday, 7:00 A.M. to 3:30 P.M. schedule will be reflected in the Contractor's bid prices and no claim for additional labor costs due to an irregular work schedule will be allowed. The Contractor is advised that shift changes from the normal 7:00 A.M. to 3:30 P.M. shall require a minimum 2 weeks advanced notice for approval, unless otherwise noted by the District Construction Office.

No work, including the setting up and taking down of work zone traffic control devices shall be done on existing roadways areas between the hours of 6:00-9:00 AM and 3:00-7:00 PM. Work shall be permitted in areas outside and off the roadway during these periods with the approval of the Engineer.

All work adjacent to the MBTA Railroad Tracks shall be performed in accordance withal rules & regulations of the MBTA, the Operating Railroad, and all other requirements contained in these Special Provisions.

WORK RESTRICTIONS

(Supplementing Subsection 8.02)

In addition to the option for expanded daily work hours, the Contractor is hereby notified that it is expected that five (5) full weekend rail shutdowns will be required to complete the work. Full weekend shutdowns will require diversions of the MBTA Commuter Rail service, which consist of suspension of rail service and provision of substitute bus transportation. The shut downs will be determined by the Contractor's schedule as approved by MassDOT and MBTA. The hours for the full weekend shut downs shall be as follows: 12:30 AM Saturday (Friday Night) through 4:00 AM Monday morning for the track area.

No weekend rail service diversions will be allowed from Memorial Day weekend through Labor Day weekend. The Contractor may coordinate with the MBTA to mobilize and/or gain partial track level access earlier than the 12:30 AM time on Friday night. The Contractor may also coordinate with the MBTA for track level access during nightly non-revenue hours (typically 12:30 AM to 4:00 AM) as well as additional work time during off-peak daily rail revenue hours, as determined and approved by the MBTA. Any and all shutdowns, track foul time, operation modifications (such as single-track operation), etc. must be requested from, and approved by the MBTA, and will be granted, conditioned, limited or terminated at any time at their discretion. No additional compensation will be made for costs related to obtaining additional track time or service diversions from the MBTA.

CONTRACTOR CLAIMS (Supplementing Subsection 7.16)

For any and all work which the Contractor is claiming payment, the contractor shall certify, with respect to such price proposal, that to the best of their knowledge and belief, the cost and pricing data submitted was accurate, complete, and current as of the date of submission. Further, with respect to any change order or contract modification under which a certification is required, the DOT shall have the right to adjust the price to the DOT, including profit or fee, to exclude any significant sums if the DOT finds that such price was increased because the contractor-furnished cost or pricing data was inaccurate, incomplete, or not current as of the date of submission.

CONTRACTUAL MILESTONES (Supplementing Subsection 8.03)

This Contract contains the following Contractual Milestones that are to be included in the Contractor's Baseline Contract Progress Schedule submission. The Contractor shall identify the completion of the work pertaining to each Contractual Milestone through the inclusion of a Finish Milestone in the Baseline Contract Progress Schedule.

To ensure that the Contractor performs the Project on schedule, MassDOT has established the following three (3) milestones defined as follows: **Contractual Milestones:**

Milestone #03 – Washington Avenue Bridge - One lane open in Northbound direction: The Contractor shall achieve Completion within **449 Calendar Days from the date the Washington Avenue Bridge is closed to traffic.** Contractor Completion for Milestone #03 is defined as the completion of all physical contract work required so that Washington Avenue may be opened to one-way traffic in the Northbound direction.

Milestone #02 – Full Beneficial Use & Substantial Completion of the Washington Avenue Bridge and Full Operation of the Busway: The Contractor shall achieve Full Beneficial Use & Substantial Completion within **700 Calendar Days from Notice to Proceed.** Contractor completion for Milestone #02 is defined as the complete demolition of the existing bridge structure, completion of the roadway approach work, and full completion of the new Bridge open to two-way traffic with both sidewalks open to pedestrians; full operation of the busway including fully operational Bus Rapid Transit Stations and shared use path further defined as follows:

Full Beneficial Use: The majority of Contract Work has been completed and the asset(s) has been opened for full multi-modal transportation use, except for limited contract work items that do not materially impair or hinder the intended public use of the transportation facility. All anticipated lane takings have been completed and removed, except for minor, short term work items.

Substantial Completion: A walkthrough of the entire Contract Work has been performed by the Resident Engineer, a Punchlist has been generated and the Work required by the Contract, including paperwork, has been completed, except for work having a contract price of less than one percent of the adjusted total contract price, including overruns, underruns and all contract amendments. All material submittals have been received by the District Materials Lab.

Milestone #01 – Contractor Field Completion: The Contractor shall achieve Contractor Field Completion within **728 Calendar Days from Notice to Proceed.** Contractor completion for Milestone #01 is defined as completion of Milestones #03 and #02 and all punch list work.

Contractor Field Completion: All physical Contract Work is complete including punch list. The Contractor has fully de-mobilized from field operations.

INCENTIVE/DISINCENTIVE REQUIREMENTS

For the purposes of this Contract, MassDOT is instituting a No Excuse Incentive/Disincentive Clause for Milestone #03 and Milestone #02. There will be no incentive or disincentive associated with Milestone #01. This specification is intended to encourage the Contractor to use innovative methodologies to achieve early completion of key milestones. To encourage such innovation, keep daily road user costs (DRUC) at a minimum, and minimize disruption to adjacent neighborhoods and businesses, MassDOT is proposing the following incentive/disincentive provisions.

Incentive/Disincentive for Milestone #03

Incentive Payments: If the Contractor successfully achieves Milestone #03 as defined above before **449** Calendar Days from Notice to Proceed, MassDOT shall pay an Incentive Payment of \$18,000.00 per Calendar Day. The Maximum Incentive Amount shall not exceed \$1,764,000.00 and 98 Calendar Days.

Disincentive Deduction: Conversely, if the Contractor achieves Milestone #03 later than **449** Calendar Days from the Notice to Proceed, MassDOT shall assess the Contractor a Disincentive Deduction of \$18,000.00 per Calendar Day. The maximum Disincentive amount shall not exceed \$1,764,000.00 and 98 Calendar Days.

Incentive/Disincentive for Milestone #02

Incentive Payments: If the Contractor successfully achieves Milestone #02 before **700** Calendar Days from Notice to Proceed, MassDOT shall pay an Incentive Payment of \$8,500.00 per Calendar Day. The maximum Incentive amount shall not exceed \$824,500 and 97 Calendar Days.

Disincentive Deduction: Conversely, if the Contractor achieves Milestone #02 later than **700** Calendar Days from the Notice to Proceed, MassDOT shall assess the Contractor a Disincentive Deduction of \$8,500.00 per Calendar Day. The maximum Disincentive amount shall not exceed \$824,500.00 and 97 Calendar Days.

Time Extensions

The Engineer shall determine time extensions in accordance with Subsection 8.10 of the Standard Specifications, Determination and Extension of Contract Time for Completion. There shall be no other basis for extension of time other than as provided in Subsection 8.10 of the Standard Specifications.

For purposes of determining whether the Contractor shall receive an Incentive Payment, the number of Calendar Days set forth in Milestone #03 and #02 will not be adjusted under any circumstances for any reason, cause, or circumstance whatsoever, regardless of fault, save for and except in the instance of a catastrophic event and/or declared state of emergency.

HOLIDAY WORK RESTRICTIONS FOR CALENDAR YEAR 2014

(Supplementing Subsection 7.09)

The District Highway Director may authorize work to continue during these specified time periods if it is determined by the District that the work will not negatively impact the traveling public.

Below are the holiday work restrictions for the calendar year 2014:

NEW YEARS DAY (FEDERAL HOLIDAY)

Wednesday January 1, 2014:

No work on major arterial roadways from noon on Tuesday December 31, 2013 until the normal start of business on Thursday January 2, 2014. No work on local roadways on the holiday without permission by the DHD and the local police chief.

MARTIN LUTHER KING'S BIRTHDAY (FEDERAL HOLIDAY)

Monday January 20, 2014:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

PRESIDENT'S DAY (FEDERAL HOLIDAY)

Monday February 17, 2014:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

EVACUATION DAY (SUFFOLK COUNTY STATE HOLIDAY)

Monday March 17, 2014:

No work restrictions due to traffic concerns.

PATRIOT'S DAY (STATE HOLIDAY)

Monday April 21, 2014:

Work restrictions will be in place for Districts 3, 4 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as to not to impact the marathon.

All other districts work restrictions will be as per DHD.

MEMORIAL DAY (FEDERAL HOLIDAY)

Monday May 26, 2014:

No work on major arterial roadways from noon on Friday May 23, 2014 until the normal start of business on Tuesday, May 27, 2014.

BUNKER HILL DAY (SUFFOLK COUNTY STATE HOLIDAY)

Tuesday June 17, 2014:

No work restrictions due to traffic concerns.

INDEPENDENCE DAY (FEDERAL HOLIDAY)

Friday July 4, 2014:

No work on major arterial roadways from noon on Thursday July 3, 2014 until the normal start of business on Monday July 7, 2014.

HOLIDAY WORK RESTRICTIONS FOR CALENDAR YEAR 2014 (Continued)**LABOR DAY (FEDERAL HOLIDAY)**

Monday September 1, 2014:

No work on major arterial roadways from noon on Friday August 29, 2014 until the normal start of business on Tuesday, September 2, 2014.

COLUMBUS DAY (FEDERAL HOLIDAY)

Monday October 13, 2014:

No work on major arterials from noon time on Friday, October 10, 2014 until the normal start of business on Tuesday, October 14, 2014. DHD may allow work in those areas on a case by case basis and where work is behind barrier and will not impact traffic.

VETERANS DAY (FEDERAL HOLIDAY)

Tuesday November 11, 2014:

No work restrictions due to traffic concerns.

THANKSGIVING DAY (FEDERAL HOLIDAY)

Thursday November 27, 2014:

No work on major arterials from noon on Wednesday November 26, 2014 until the normal start of business on the Monday December 1, 2014.

CHRISTMAS DAY (FEDERAL HOLIDAY)

Thursday December 25, 2014:

No work on major arterial roadways from noon on Wednesday December 24, 2014 until the normal start of business on Friday December 26, 2014.

HOLIDAY WORK RESTRICTIONS FOR CALENDAR YEARS 2015 & 2016 (Continued)

Below are the holiday work restrictions for the calendar years 2015 and 2016:

NEW YEARS DAY (FEDERAL HOLIDAY)

Thursday January 1, 2015, Friday January 1, 2016:

No work on major arterial roadways from noon on Wednesday December 31, 2014 until the normal start of business on Friday January 2, 2015 and from noon on Thursday December 31, 2015 until the normal start of business on Monday January 4, 2016. No work on local roadways on the holiday without permission by the DHD and the local police chief.

MARTIN LUTHER KING'S BIRTHDAY (FEDERAL HOLIDAY)

Monday January 19, 2015, Monday January 18, 2016:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

PRESIDENT'S DAY (FEDERAL HOLIDAY)

Monday February 16, 2015, Monday February 15, 2016:

No work restrictions due to traffic concerns however work on local roadways requires permission by the DHD and local police chief.

HOLIDAY WORK RESTRICTIONS FOR CALENDAR YEARS 2015 & 2016 (Continued)**EVACUATION DAY (SUFFOLK COUNTY STATE HOLIDAY)**

Tuesday March 16, 2015, Thursday March 17, 2016:

No work restrictions due to traffic concerns.

PATRIOT'S DAY (STATE HOLIDAY)

Monday April 20, 2015, Monday April 18, 2016:

Work restrictions will be in place for Districts 3, 4 and 6 along the entire Boston Marathon route and any other locations that the DHD in those districts determine are warranted so as to not to impact the marathon.

All other districts work restrictions will be as per DHD.

MEMORIAL DAY (FEDERAL HOLIDAY)

Monday May 25, 2015, Monday May 30, 2016:

No work on major arterial roadways from noon on Friday May 23, 2014 until the normal start of business on Tuesday, May 27, 2014.

INDEPENDENCE DAY (FEDERAL HOLIDAY)

Saturday July 4, 2015, Monday July 4, 2016:

No work on major arterial roadways from noon on Thursday July 3, 2014 until the normal start of business on Monday July 7, 2014.

LABOR DAY (FEDERAL HOLIDAY)

Monday September 7, 2015, Monday September 5, 2016:

No work on major arterial roadways from noon on Friday September 4, 2015 until the normal start of business on Tuesday, September 8, 2015. No work on major arterial roadways from noon on Friday September 2, 2016 until the normal start of business on Tuesday September 6, 2016.

COLUMBUS DAY (FEDERAL HOLIDAY)

Monday October 12, 2015, Monday October 10, 2016:

No work restrictions due to traffic concerns.

VETERANS' DAY (FEDERAL HOLIDAY)

Wednesday November 11, 2015, Friday November 11, 2016:

No work restrictions due to traffic concerns.

THANKSGIVING DAY (FEDERAL HOLIDAY)

Thursday November 26, 2015, Thursday November 24, 2016:

No work on major arterials from noon on Wednesday November 25, 2015 until the normal start of business on the Monday November 30, 2015. No work on major arterials from noon on Wednesday November 23, 2016 until the normal start of business on the Monday November 28, 2016.

CHRISTMAS DAY (FEDERAL HOLIDAY)

Friday December 25, 2015, Sunday December 25, 2016:

No work on major arterial roadways from noon on Thursday December 24, 2015 until the normal start of business on Monday December 28, 2015. No work on major arterial roadways from noon on Friday December 23, 2016 until the normal start of business on Tuesday December 27, 2016

PROMPT PAYMENT AND RELEASE OF RETAINAGE TO SUBCONTRACTORS

Contractors are required to promptly pay Subcontractors under this Prime Contract within ten (10) business days from the receipt of each payment the Prime Contractor receives from MassDOT. Failure to comply with this requirement may result in the withholding of payment to the Prime Contractor until such time as all payments due under this provision have been received by the Subcontractor(s) and/or referral to the Prequalification Committee for action which may affect the Contractor's prequalification status. The Contractor further agrees to make payment in full, including Retainage, to each Subcontractor no later than ten (10) business days after the Subcontractor has completed all of the work required under its subcontract.

MASSHIGHWAY TO MASSDOT NAME CHANGE

The following definitions in Section 100 of the Standard Specifications for Highways and Bridges are revised as follows:

(Amend definition of Department)

- 1.17 –DepartmentEffective November 1, 2009, St. 2009, c. 25 abolishes the Massachusetts Department of Highways and all assets, liabilities, and obligations become those of the Massachusetts Department of Transportation ("MassDOT). Anywhere in this contract the terms Commission, Commonwealth, Department of Public Works, Department, Massachusetts Highway Department, MassHighway, Party of the First Part, or any other term intending to mean the former Massachusetts Department of Highways is used, it shall be interpreted to mean MassDOT or applicable employee of MassDOT unless the context clearly requires otherwise. Furthermore, MassDOT by operation of law inherited all rights and obligations pursuant to any contract, and therefore parties to this contract hereby acknowledge and agree that its terms shall be liberally construed and interpreted to maintain the rights and obligations of MassDOT. Furthermore, the parties hereby acknowledge and agree that the transfer of all rights and obligations from the Massachusetts Department of Highways to MassDOT shall not have the effect of altering or eliminating any provision of this contract in a manner that inures to the detriment of MassDOT.

(Add a definition for MassDOT)

- 1.46 – MassDOT.....The Massachusetts Department of Transportation, a body politic and corporate, under St. 2009, c. 25 "An Act Modernizing the Transportation Systems of the Commonwealth", as amended.

MASSDOT HIGHWAY DIVISION CONSTRUCTION SECTION
SOP CSD 27-20-2-000 ATTACHMENT A LANGUAGE FOR
SUBCONTRACTOR COMPLETION TO BE ADDED TO
SUBCONTRACTOR APPROVAL PAPERWORK

Issued September 2, 2013

Consistent with the Special Provisions section titled Prompt Payment and Release of Retainage to Subcontractors and State and Federal prompt payment regulations; 49 CFR Part 26.29 and MGL Chapter 30, Section 39F, the Contractor and Subcontractor are reminded that upon successful completion of the Subcontractor's work, all retainage held by the Prime Contractor must be returned to the Subcontractor, regardless of the status of the contract work as a whole.

The Subcontractor must notify the Contractor and MassDOT in writing that the Subcontractor has completed all of its work scope and request a final inspection of the work and release of retainage.

The Contractor may, in turn, request in writing that the Department also conduct an inspection of the Subcontractor's work before the Contractor releases retainage to the Subcontractor. The request must include a certification by the Contractor that the Subcontractor's work is complete and in conformance with the terms and conditions of the MassDOT contract.

If the Contractor decides for any reason that the retainage should not be released to the Subcontractor, the Contractor must notify MassDOT in writing what those reasons are, in sufficient detail for MassDOT to determine whether the Contractor's decision is appropriate.

If the Department has held retainage on the Subcontractor's work, and the Contractor wishes to have the retainage released, the Contractor must submit in writing a request to MassDOT for inspection of the work and release of retainage on the Subcontractor's work. The request must include a certification by the Contractor that the Subcontractor's work is complete and in conformance with the terms and conditions of the MassDOT contract. Retainage released by MassDOT for a Subcontractor's completed work shall be promptly passed on to the Subcontractor in accordance with the Prompt Payment provisions.

Upon receipt of full payment by the Subcontractor, the Subcontractor shall promptly record in the EBO system that full payment has been received.

The Contractor and Subcontractor are directed to the following: Division I, Section 9.02 Scope of Payments, 2nd paragraph, which provides that the release of retainage shall not constitute acceptance of the work and that any defects found before the Final Acceptance of the work shall be corrected at no cost to the Department. Division I, Section 5.09 Inspection of Work, 7th paragraph, which provides that inspection of the work shall not relieve the Contractor of any obligations to fulfill the terms of the contract.

SUBSECTION 8.14 UTILITY COORDINATION, DOCUMENTATION, AND MONITORING RESPONSIBILITIES

A. - GENERAL

In accordance with the provisions of Section 8.00 Prosecution and Progress, utility coordination is a critical aspect to this Contract. This section defines the responsibility of the Contractor and MassDOT, with regard to the initial utility relocation plan and changes that occur as the prosecution of the Work progresses. The Engineer, with assistance from the Contractor shall coordinate with Utility companies that are impacted by the Contractor's operations. To support this effort, the Contractor shall provide routine and accurate schedule updates, provide notification of delays, and provide documentation of the steps taken to resolve any conflicts for the temporary and/or permanent relocations of the impacted utilities. The Contractor shall provide copies to the Engineer of the Contractor communication with the Utility companies, including but not limited to:

- Providing advanced notice, for all utility-related meetings initiated by the Contractor.
- Providing meeting minutes for all utility-related meetings that the Contractor attends.
- Providing all test pit records.
- Request for *Early Utility* work requirements of this section (see below).
- Notification letters for any proposed changes to Utility start dates and/or sequencing.
- Written notification to the Engineer of all apparent utility delays within seven (7) Calendar Days after a recognized delay to actual work in the field – either caused by a Utility or the Contractor.
- Any communication, initiated by the Contractor, associated with additional Right-of-Way needs in support of utility work.
- Submission of completed Utility Completion Forms.

B. - PROJECT UTILITY COORDINATION (PUC) FORM

The utility schedule and sequence information provided in the Project Utility Coordination Form (if applicable) is the best available information at the time of the bid and has been considered in setting the contract duration. The Contractor shall use all of this information in developing the bid price and the Baseline Schedule Submission, inclusive of the individual utility durations sequencing requirements, and any work that has been noted as potentially concurrent utility installations.

C. -INITIATION OF UTILITY WORK

The Engineer will issue all initial notice-to-proceed dates to each Utility company based on either the:

- 1) Contractor's accepted Baseline Schedule
- 2) An approved Early Utility Request in the form of an Early Utility sub-net schedule (in accordance with the requirements of this Subsection)
- 3) An approved Proposal Schedule

SUBSECTION 8.14 (Continued)**C.1 - BASELINE SCHEDULE – UTILITY BASIS**

The Contractor shall provide a Baseline Schedule submission in accordance with the requirements of Subsection 8.02 and inclusive of all of the information provided in the PUC Form that has been issued in the Contract documents. This is to include the utility durations, sequencing of work, allowable concurrent work, and all applicable considerations that have been depicted on the PUC Form.

C.2 – EARLY UTILITY REQUEST – (aka SUBNET SCHEDULE) PRIOR TO THE BASELINE

All early utility work is defined as any anticipated/required utility relocations that need to occur prior to the Baseline Schedule acceptance. In all cases of proposed early utility relocation, the Contractor shall present all known information at the pre-construction conference in the form of a ‘sub-net’ schedule showing when each early utility activity needs to be issued a notice-to-proceed. The Contractor shall provide advance notification of this intent to request early utility work in writing at or prior to the Pre-Construction meeting. Prior to officially requesting approval for early utility work, the Contractor shall also coordinate with MassDOT and all utility companies (private, state or municipal) which may be impacted by the Contract. If this request is acceptable to the Utilities and to MassDOT, the Engineer will issue a notice-to-proceed to the affected Utilities, based on these accepted dates.

C.3 – PROPOSAL SCHEDULE - CHANGES TO THE PUC FORM

If the Contractor intends to submit a schedule (in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02) that contains durations or sequencing that vary from those provided in the Project Utility Coordination (PUC) Form, the Contractor must submit this as an intended change, in the form of a Proposal Schedule and in accordance with MassDOT Standard Specifications, Division I, Subsection 8.02. These proposed changes are subject to the approval of the Engineer and the impacted utilities, in the form of this Proposal Schedule and a proposed revision to the PUC form. The Contractor shall not proceed with any changes of this type without written authorization from the Engineer, that references the approved Proposal Schedule and PUC form changes. The submission of the Baseline Schedule should not include any of these types of proposed utility changes and should not delay the submission of the Baseline Schedule. As a prerequisite to the Proposal Schedule submission, and in advance of the utility notification(s) period, the Contractor shall coordinate the proposed utility changes with the Engineer and the utility companies, to develop a mutually agreed upon schedule, prior to the start of construction.

D. – UTILITY DELAYS

The Contractor shall notify the Engineer upon becoming aware that a Utility owner is not advancing the work in accordance with the approved utility schedule. Such notice shall be provided to the Engineer no later than seven (7) calendar days after the occurrence of the event that the Contractor believes to be a utility delay. After such notice, the Engineer and the Contractor shall continue to diligently seek the Utility Owner’s cooperation in performing their scope of Work.

SUBSECTION 8.14 (Continued)

In order to demonstrate that a critical path delay has been caused by a third-party Utility, the Contractor must demonstrate, through the requirements of the monthly Progress Schedule submissions and the supporting contract records associated with Subsection 8.02, 8.10 and 8.14, that the delays were beyond the control of the Contractor.

All documentation provided in this section is subject to the review and verification of the Engineer and, if required, the Utility Owner. In accordance with MassDOT Specifications, Division I, Subsection 8.10, a Time Extension will be granted for a delay caused by a Utility, only if the actual duration of the utility work is in excess of that shown on the Project Utility Coordination Form, and only if;

- 1) proper Notification of Delay was provided to MassDOT in accordance with the time requirements that are specified in this Section
- 2) the utility delay is a critical path impact to the Baseline Schedule (or most recently approved Progress Schedule)

E. - LOCATION OF UTILITIES

The locations of existing utilities are shown on the Contract drawings as an approximation only. The Contractor shall perform a pre-construction utility survey, including any required test pits, to determine the location of all known utilities no later than thirty (30) calendar days before commencing physical site work in the affected area.

F. - POST UTILITY SURVEY – NOTIFICATION

Following completion of a utility survey of existing locations, the Contractor will be responsible to notify the Engineer of any known conflicts associated with the actual location of utilities prior to the start of the work. The Engineer and the Contractor will coordinate with any utility whose assets are to be affected by the Work of this Contract. A partial list of utility contact information is provided in the Project Utility Coordination Form.

G. - MEETINGS AND COOPERATION WITH UTILITY OWNERS

The Contractor shall notify the Engineer in advance of any meeting they initiate with a Utility Owner's representative to allow MassDOT to participate in the meeting if needed.

Prior to the Pre-Construction Meeting, the Contractor should meet with all Utility Owners who will be required to perform utility relocations within the first 6 months of the project, to update the affected utilities of the Project Utility Coordination Form and all other applicable Contract requirements that impact the Utilities. The Contractor shall copy the Engineer on any correspondence between the Utility Owner and the Contractor.

H. - FORCE ACCOUNT / UTILITY MONITORING REQUIREMENTS

The Engineer will be responsible for recording daily Utility work force reports. The start, suspension, re-start, and completion dates of each of the Utilities, within each phase of the utility relocation work, will be monitored and agreed to by the Engineer and the Contractor as the work progresses.

SUBSECTION 8.14 (Continued)**I. - ACCESS AND INSPECTION**

The Contractor shall be responsible for allowing Utility owners access to their own utilities to perform the relocations and/or inspections. The Contractor shall schedule their work accordingly so as not to delay or prevent each utility from maintaining their relocation schedule.

PROTECTION OF UNDERGROUND FACILITIES

The Contractor's attention is directed to the necessity of making his own investigation in order to assure that no damage to existing structures, drainage lines, traffic signal conduits, etcetera, will occur.

The Contractor shall notify Massachusetts DIG SAFE and procure a Dig Safe Number for each location prior to disturbing existing ground in any way. The telephone number of the Dig Safe Call Center is 811 or 1-888-344-7233.

NOTICE TO OWNERS OF UTILITIES

The Contractor shall investigate to determine the existence of utilities that may be affected by the Contractors operations.

Written notice shall be given by the Contractor to all public service corporations or officials owning or having charge of publicly or privately owned utilities of his/her intention to commence operations affecting such utilities at least one week in advance of the commencement of such operations and the Contractor shall at that time file a copy of such notice with the Engineer.

Before the Contractor begins any work or operations which might damage any subsurface structures, he shall carefully locate all such structures and conduct his operations such as to avoid any damage to them.

The District Office maintains a list of utility contact persons, addresses, and telephone numbers for each town, which may be requested by the Contractor for each location of work.

A list of public and private utilities can be found on the MassDOT website at:

<http://www.massdot.state.ma.us/highway/Main.aspx>

Select Doing business with us

Select Design/Engineering

Select Utility Contacts

Select District 2 on top of the webpage, select the City of Chelsea,
and then locate the utility.

NOTICE TO OWNERS OF UTILITIES (Continued)

Town officials are shown at website <http://www.mass.gov>. From the Main Menu Selection Box select “Government, Taxes & Public Service”, select “Local & County Government”, select “Cities & towns”, then in the right margin under “Related Links” select “Contact information for city and town officials”. Enter the city/town on the left of the webpage and locate the official to contact.

State Police are shown at website <http://www.mass.gov> by entering “Troop Boundaries” in the search box and selecting the resulting “Troop Boundaries” link. Select the area of jurisdiction to find the local station.

The above links should be used to verify the contacts:

Utility contact list below is for guidance only and not guaranteed to be complete or up to date.

Water & Sewer

Chelsea Water & Sewer Department
500 Broadway
Chelsea MA 02150
Attn: Andrew DeSantis
Tel. (617) 466-4206

Electric

NSTAR Electric & Gas Company
One NSTAR Way
Westwood, MA 02090
Attn: Steve Owens
Tel. (508) 441-5881

Public Works

Chelsea Department of Public Works
500 Broadway
Chelsea MA 02150
Attn: Joseph Foti
Tel. (617) 466-4200

Gas

National Grid (Gas)
40 Sylvan Road
Waltham, MA 02451
Attn: Melissa Owens
Tel. (781) 907-2845

Fire Alarm

Chelsea Emergency Management
500 Broadway
Chelsea, MA 02150
Attn: Allen Alpert
Tel. (617) 466-4620

Telephone

Verizon
385 Myles Standish Boulevard
Taunton, MA 02780
Attn: Karen Nunes
Tel. (508) 826-6430

MWRA Water

MWRA
2 Griffin Way
Chelsea MA 02150
Attn: Ralph Francesconi
Tel. (617) 305-5827

Other

Crown Castle
131-05 14th Avenue
College Point, NY 11356
Attn: Joseph Guido
Tel. (917) 563-3684

MWRA Sewer

MWRA
2 Griffin Way
Chelsea, MA 02150
Attn: Kevin McKenna
Tel. (617) 305-5956

MassDOT District 6 Highway

185 Kneeland Street
Boston, MA 02111
District Utility Constructability Engineer
Attn: Anthony Christakis
Tel. (857) 368-6167

PROTECTION OF UTILITIES AND PROPERTY (Supplementing Subsection 7.13)

The Contractor, in constructing or installing facilities alongside or near sanitary sewers, storm drains, water or gas pipes, electric or telephone conduits, poles, sidewalks, walls or other structures, shall, at his expense, sustain them securely in place, cooperating with the officers and agents of the various utility companies and municipal departments which control them, so that the services of these structures shall be maintained. He shall also be responsible for the repair or replacement, at his own expense, of any damage to such structures caused by his acts or neglect, and shall leave them in the same condition as they existed prior to the commencement of work. In case of damage to utilities, the Contractor shall promptly notify the Owner and shall, if requested by the Engineer, furnish laborers to work temporarily under the Owner's direction in providing access to the utility. Pipes or other structures damaged by the operation of the Contractor may be repaired by the City of Chelsea, or by the utility company which suffers the loss. The cost of such repairs shall be borne by the Contractor, without compensation therefore.

If, as the work progresses, it is found that any of the utility structures are so placed as to render it impracticable, in the judgment of the Engineer, to do the work called for under this Contract, the Contractor shall protect and maintain the services in such utilities and structures and the Department will, as soon thereafter as it reasonably can, cause the position of the utilities to be changed or take such other action as it deems suitable and proper.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in protecting or repairing property as specified in this Section shall be considered as included in the prices paid for the various contract items of work and no additional compensation will be allowed therefore.

The Contractor will cooperate fully with all utility companies private or public, and will notify all such companies at least forty-eight hours prior to excavating in the vicinity of any utility. It is understood that the Contractor has considered in his bid the existence of the various utilities and that no additional compensation will be allowed for any delays, inconvenience, or damage sustained by him due to any interference by said utilities, unless said compensation is authorized in writing by the Engineer as specified under Subsection 4.03 for Extra Work.

For utility connections, the serving utility will make any required connections to the power source. The Contractor shall supply all labor, materials and equipment to install the service connections, complete in place and in accordance with National Grid procedures. Enough wire shall be coiled within the electric manholes/handholes serving utility to make the final connection.

The Contractor shall pay the serving utility for their services rendered for the connection of the service connections.

The Contractor shall, at his own expense, preserve and protect from injury and damage the existing building at 63 Washington Avenue, and he shall be responsible for a repair at his own expense any and all damage and injury thereto, arising out of or in consequence of his execution of the work, or in consequence of non-execution thereof by the Contractor or his employees or Subcontractors in the performance of the work covered by the Contract prior to completion and acceptance of thereof.

PROTECTION OF UTILITIES AND PROPERTY (Continued)

Contractor shall conduct a pre-construction building condition survey, perform geotechnical instrumentation and monitoring, and conduct a post-construction building condition survey for the 63 Washington Avenue building as required in Special Provision Item 100.91, Pre and Post Construction Survey Geotechnical Instrumentation and Monitoring – Site 1.

The Contractor shall be aware of existing fiber optic cable lines running generally under the proposed busway from Mystic Mall Station to a point just east of Broadway. Portions of these lines are owned by Bell Canada and are part of the Transatlantic Cable Network. Contractor shall take extra caution in working around these lines and shall excavate test pits for identifying exact locations utilizing a vacuum truck. Contractor shall protect in place as directed by the Engineer.

DRAINAGE (Supplementing Subsection 7.13)

It shall be the Contractor's responsibility to maintain the temporary drainage system within the project limits as defined by the Engineer. The Contractor will maintain positive drainage within the project limits (and the immediate vicinity) at all times throughout the construction phase.

It shall be the responsibility of the Contractor to make certain that all drainage systems, either new or existing, that carry drainage run-off from the limits of this project operate efficiently to their point of discharge.

Pipes and structures requiring cleaning as a result of accumulations from the construction operations shall be cleaned without additional compensation

The castings of all structures, which are required to be set or reset under this project, shall not be set complete in place to the final grade until after the bituminous concrete binder course has been completed and top course is scheduled to be completed with 2 weeks.

Before placement of top course material begins, utility structures shall be adjusted to final grade. Utility structures shall be exposed above binder grade for not more than two (2) weeks before placement of top course material will be required. All Catch Basin structures shall be set flush with finish grade.

All the above work shall be included under the relevant drainage item without additional compensation therefore. Any adjustments made to new drainage structures will be included under the contract unit price for the respective structures.

BORINGS

(Supplementing Subsection 2.03)

The borings as indicated on the plans were taken for the purpose of design of foundations. They do not necessarily show the actual nature of the material that may be encountered in the excavation. Material encountered in the excavation may include water pipe, gas pipe, and other utility services, and may also include cribbing, piling, masonry and other materials from previous constructions. The Contractor shall make his own investigations to ascertain the presence of utilities and former constructions. The bid by the Contractor and its acceptance by the Department will be considered as a mutual agreement that the removal and disposal of all materials encountered in excavation, regardless of their nature or size, will be considered as included under the general items for excavation; and there shall be no addition to the Contract unit price for the item if the operation is more difficult or more costly than is implied by the preliminary information, and there shall be no deduction from the contract unit price if the operation is less difficult or less costly than is implied by the preliminary information.

Soil Boring Logs are included in Document A00805 - GEO-TECH REPORT AND BORING LOGS, Appendix C to these Special Provisions.

ORDERING OF MATERIALS AND DRAWINGS

The Contractor shall provide the Department, within thirty (30) days of receipt of the contract, written evidence that:

1. He has ordered the shop drawings for the materials for which shop drawings are required on the subject contract and;
2. He has ordered from a supplier or manufacturer, the catch basin frames, grates and other casting necessary to complete the project.

The Contractor shall further provide the Department written evidence within 30 days of receipt of the contract that these orders have been confirmed in writing by the manufacturer with delivery dates appropriate for timely completion of the project. These confirmations of orders will become part of the project records.

Failure to comply with any of the ordering requirements shall nullify a request for an extension of the project completion date as a consequence of late delivery of signal control devices or castings.

No work requiring highway lighting installation shall start until the necessary equipment and components have been received by the Contractor or unless permission has been given to the Contractor by the Department.

COORDINATION BY CONTRACTOR

(Supplementing Subsection 5.06)

The Contractor shall be fully responsible for arranging and coordinating his work with the work to be performed by others. The coordination and phasing shall be submitted to the Engineer for his approval.

The Contractor is advised that work required on private utilities, made necessary by the construction of this project, will be performed by the respected utility companies. Also agents of either the municipality or other public utilities or service agencies may be required to enter the work site to perform work necessary for their systems. Refer to NOTICE TO OWNERS OF UTILITIES (Supplementing Subsection 7.13) for the contact names of the private utilities in the project area.

The Contractor shall perform the work in cooperation with these various agencies in a manner which causes the least interference with the operations of the aforementioned agencies and shall have no claim for additional compensation for delay which may be due to, or result from, said work of these agents.

ARCHITECTURAL ACCESS BOARD TOLERANCES

The Contractor is hereby notified that they are ultimately responsible for constructing all project elements in strict compliance with the current AAB/ADA rules, regulations and standards.

All construction elements in this project associated with sidewalks, walkways, wheelchair ramps and curb cuts are controlled by 521CMR - Rules and Regulations of the Architectural Access Board (AAB).

The AAB Rules and Regulations specify maximum slopes and minimum dimensions required for construction acceptance. There is no tolerance allowed for slopes greater than the maximum slope nor for dimensions less than the minimum dimensions.

Contractors shall establish grade elevations at all wheel chair ramp locations, and shall set transition lengths according to the appropriate table in the Construction Standards (or to the details shown on the plans).

All wheelchair ramp joints and transition sections which define grade changes shall be formed, staked and checked prior to placing cement concrete. All grade changes are to be made at joints.

INSURANCE REQUIREMENTS (Supplementing Section 7.05)

The insurance requirements set forth in this section are in addition to the requirements of the Standard Specifications and supercede all other requirements .

RAILROAD PROTECTIVE INSURANCE

Railroad Protective Liability Insurance and Protective Property Damage Liability Insurance shall be obtained b the Contractor in the amount of **\$6,000,000/\$10,000,000**, on behalf of the **MBTA, the Operating Railroad, CSXT and PanAm**.

Railroad Operations Directorate: Section F:

Railroad Protective Insurance(Required if work is performed within 50 feet of railroad track).

1. The Contractor shall furnish, with respect to the operations of the Contractor or any of the Contractor's Subcontractors performing within the Railroad right-of-way, broad form Railroad Protective Liability Insurance covering all work performed under this Contract in the amount of not less than \$6,000,000 per occurrence, \$10,000,000 aggregate combined bodily injury and property damage.
2. Such insurance shall be written on an occurrence basis.
3. The MBTA and applicable railroads shall be the named insureds on such insurance.
4. The Contractor shall furnish to the MBTA and railroad companies a signed original of the Railroad Protective Liability Policy prior to entry upon the railroad right-of-way.
5. Such policies shall provide 30 days notice to each named insured by the insurance company before any change or cancellation of the policies.
6. Such Railroad Protective Insurance policies may be provided in forms commonly referred to as AAR/AASHTO or ISO/RIMA but not Oregon.

Questions regarding insurance should be directed to the MBTA's Risk Manager at 617-222-3064.

The contractor shall be aware of the latest MBTA insurance limits / requirements. See the following link for more information:

<http://www.transitrealty.com/licenses/>

CONCRETE WORK

The various classes of concrete shall conform to the applicable requirements of Section 901 of the standard Specifications with the following conditions. Where the Contractor is given the option of cast-in-place concrete or precast units, the steel reinforcements shall be the same, whichever is used. If a lifting hook is required for a precast unit, it shall be so placed that it will neither cramp the space for work to be done within the unit nor appear on the exposed surface of the completed work. Surfaces that will be exposed in the completed work shall be finished with a wood float.

All concrete forms except sheeting, whether below or above grade, shall be removed. Steel reinforcement shall conform to the applicable provisions of Subsection M8.01.0 of the standard Specifications, except that bars used for pulling irons shall be plain bars without deformation. Where anchor bolts are to be embedded in concrete, the embedment shall be made in accordance with the bolt circle template acquired from and furnished by the manufacturer of the item to be anchored. The bolt location must be oriented to place the item in the required position with respect to the street and the intent shown on the Contract Plans.

PERMITS AND LICENSES (Supplementing Subsection 7.03)

Before any electrical connections are made the Contractor shall submit a copy of the master electrician's license who is an owner of the company that will do the work on the project, copies of the current licenses of all electricians who will perform the electrical work. Within ten (10) days after opening of bids, the low bidder shall submit a list of the Journeyman Electricians (MA license) who will perform the electrical work in this contract, along with copies of each Journeyman Electrician's current Massachusetts license.

The Contractor will also be required to obtain a Building Permit from the Commonwealth of Massachusetts Department of Public Safety, Division of Inspections. MassDOT and the Designers will assist in the preparation of the building permit application.

NPDES CONSTRUCTION GENERAL PERMIT

A Notice of Intent for coverage under the general permits shall be filed with the United States Environmental Protection Agency (EPA)/MA DEP in accordance with the NPDES permit program. It is the Contractor's responsibility to be aware of and comply with the applicable restrictions and requirements and plan his/her work and schedule accordingly.

The Contractor is advised that no additional compensation will be allowed for work required to establish, achieve, and maintain compliance with the NPDES permit program, as payment for the work shall be included in Item 756, NPDES Storm Water Pollution Prevention Plan, as appropriate.

PRESERVATION OF ROADSIDE GROWTH

(Section 8.08 shall be amended as follows)

The Contractor shall take all necessary care when excavating or working in the vicinity of existing trees so that the root systems, trunks, and branches are not damaged. All precautions shall be taken to insure that heavy equipment does not damage any roots, including those that lie below the limits of excavation.

Do not store equipment or stockpile materials within drip line of trees or in areas enclosed by tree protection fencing.

Avoid any direct soil contamination in root zone area by petroleum, petroleum products or solvents, salts or any other pollutant during construction.

All cutting or trimming of trees to be preserved shall be performed by a Massachusetts Certified Arborist. The Contractor shall provide the Engineer with a copy of the certification prior to any work on trees.

Individual trees close to construction may be protected using individual tree protection as specified under Item 102.51.

Trees that, in the judgment of the Engineer, have been irreparably damaged by the Contractor shall be replaced in kind and in size, or, with a quantity of 2 inch caliper replacement trees (the quantity of which shall be determined by the Engineer) such that the cumulative caliper of the replacement trees will be up to the equivalent of diameter of the lost tree at breast height. Cost of replacement trees shall be paid by the Contractor.

Cost of removal of destroyed tree, including roots and stump, as well as the cost of replacement trees, shall be paid for by the Contractor.

EROSION AND SEDIMENTATION CONTROL

Temporary erosion and sediment control provisions shall be coordinated with the permanent erosion control features to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period. For all phases of construction, Best Management Practices for erosion and sedimentation control shall be utilized to minimize potential impacts to natural resources and wildlife. All disturbed or exposed soil must be temporarily stabilized within 30 days of disturbance or exposure.

Prior to the start of construction, the Contractor shall submit for acceptance its written methods and schedules for accomplishment of temporary and permanent grading, paving and excavation. The Contractor shall also submit its proposed method of dealing with erosion and sediment control and its plan for disposal of waste material in written form. No work shall be started until the control methods and schedules of operation have been accepted by the Engineer.

The Engineer has the authority to limit the surface areas of erodible earth material exposed by excavation, borrow and fill, or any such operations, and to direct the Contractor to provide immediate, permanent or temporary control measures to prevent contamination of surface waters.

Such measures will involve the construction of compost filter tubes, sedimentation basins, silt fences or other control devices or methods as necessary to control erosion and sedimentation. Erosion and sedimentation controls shall be installed prior to the start of work and shall be inspected daily. Sediment shall be removed from behind all erosion and sediment control measures as directed by the Engineer.

The erosion and sediment control features installed by the Contractor shall conform to the requirements of the Massachusetts Department of Environmental Protection Water Quality Certification and other permits and shall be satisfactorily maintained by the Contractor.

DEWATERING

The Contractor's attention is directed to construction operations which may occur in rivers, harbor and other areas where surface water or groundwater may exist or accumulate. The Contractor shall include under each pertinent item all labor, materials and equipment necessary to dewater the affected areas for proper installation of the respective items. All dewatering procedures must be approved by the Engineer and in accordance with environmental regulations and permits. No additional compensation will be made for dewatering, but payment for the work shall be included in the various bid items.

ENVIRONMENTAL PERMITTING**US ARMY CORPS OF ENGINEERS - 404 Category II General Permit**
MA DEPT OF ENVIRONMENTAL PROTECTION - Water Quality Certification

This project is subject to an US Army Corps of Engineers (USACOE) Category 2 Massachusetts General Permit, issued by the USACOE New England District Regulatory Division, under Section 404 of the Federal Clean Water Act. This project is also subject to a Massachusetts Department of Environmental Protection (MADEP) Water Quality Certificate (WQC), issued by the MADEP, under Section 401 of the Clean Water Act. The conditions of the Category 2 General Permit and the WQC are considered to be part of this contract and a copy of these Permits and all plans/attachments shall be on-site while activities regulated by the Permits are being performed

The Contractor's attention is directed to the fact that special conditions and other requirements are associated with the Environmental Permits. It is the Contractor's responsibility to be aware of and comply with these conditions and requirements and plan his/her work and schedule accordingly. The Contractor is hereby notified that he/she will be responsible and held accountable for performing any/all work necessary to satisfy and comply with the entire OOC.

Copies of the Army Corps of Engineers Category 2 Massachusetts General Permit (Permit No. NAE-2013-02144) and the Massachusetts Department of Environmental Protection Water Quality Certificate are contained herein. The Contractor is advised that no additional compensation will be allowed for work required to establish, achieve, and maintain compliance with these permits, as payment for the work shall be included in the applicable bid items.

PROTECTION AND RESTORATION OF PROPERTY

(Supplementing Subsection 7.13)

Contractor shall be required to schedule and coordinate his work in such a manner as to allow continuous operation and maintenance of the Operating Railroad. These include, but are not limited to, maintaining passenger service of commuter rail trains, including unscheduled mid-day train movements, freight trains, track and signal systems, and communications systems.

It shall be the Contractor's responsibility to maintain the temporary drainage system within the project limits as defined by the Engineer. The Contractor will maintain positive drainage within the project limits (and the immediate vicinity) at all times throughout the construction phase.

It shall be the responsibility of the Contractor to make certain that all drainage systems, either new or existing, that carry drainage run-off from the limits of this project operate efficiently to their point of discharge. Pipes and structures requiring cleaning as a result of accumulations from the construction operations shall be cleaned without additional compensation.

PROTECTION AND RESTORATION OF PROPERTY (Continued)

The Contractor, in crossing under or in running parallel to or near drains, sewers, gas pipes, water mains, poles, sidewalks and other structures, shall at Contractor's expense sustain them securely in place, cooperating with the officers and agents of the various companies and municipal departments which control them, so that the services of these structures may be maintained. The Contractor shall be responsible for all above or below ground utilities and shall repair at his/her own expense any damage to such structures caused by his/her act or neglect, and shall leave them in as good condition as they were previous to the commencement of the work. In cases of damage to utilities caused by the Contractor resulting in an emergency, the Contractor shall promptly warn the owner and shall, if requested, furnish laborers to work temporarily under the owner's direction in getting access to the utility. Pipes or other structures damaged by the operation of the Contractor may be repaired by the company that suffers the loss. The cost of such repairs shall be at the expense of the Contractor.

The Contractor shall not damage or impair the MBTA power lines, signal lines, fiber optic lines, conduits or structures in the areas under construction.

If live service connections are to be interrupted by excavations of any kind, the Contractor shall not break the service until new services are provided. Abandoned services shall be plugged or otherwise made secure.

Before the Contractor begins any work that may possibly damage or impair the use of any subsurface structure, he shall carefully locate the structure by hand tool excavation and shall conduct his operations so as to avoid damage or impairment.

The Contractor shall preserve and protect from injury and damage the existing buildings at 63 Washington Avenue and 598 Broadway, and he shall be responsible for a repair at his own expense any and all damage and injury thereto, arising out of or in consequence of his execution of the work, or in consequence of non-execution thereof by the Contractor or his employees or Subcontractors in the performance of the work covered by the Contract prior to completion and acceptance of thereof.

Contractor shall conduct a pre-construction building condition survey, perform geotechnical instrumentation and monitoring, and conduct a post-construction building condition survey for the 63 Washington Avenue and 598 Broadway buildings as required in Special Provision Item 100.91 and 100.92, Pre and Post Construction Survey Geotechnical Instrumentation and Monitoring, Site 1 and Site 2.

MBTA COORDINATION – SUBSTITUTE BUSING

Substitute bus transportation will be required for weekend MBTA Commuter Rail shutdowns. The Contractor must coordinate with MBTA Railroad Operations Department for any shutdowns. The Contractor shall contact MBTA Railroad Operations Department a minimum of 6 weeks prior to any planned rail shutdown. The Contractor will be responsible for planning, procuring, administering, and coordinating with the MBTA for the necessary substitute bus transportation services and operations based on the Contractor's approved work schedule.

Prime Contact: Mr. Corey Lynch	Secondary Contact: Mr. Tom Foster
Deputy Director-RR Operations	MBTA RR Operations
32 Cobble Hill Road	32 Cobble Hill Road
Somerville, MA 02143	Somerville, MA 02143
Office: 617-222-1776	Office: 617-222-1776
Cell: 617-388-4388	tfoster@mbta.com
cnlynch@mbta.com	

The Contractor shall be required to attend the MBTA Weekly Track Outage Schedule Coordination Meetings held Wednesdays at 10:00 am at 32 Cobble Hill Road in the small classroom located in the training area at the rear of the building.

No additional compensation will be made for MBTA coordination.

Compensation for substitute bus transportation will be paid by the Contractor for actual costs incurred for busing. The Department will pay the Contractor for all busing costs approved by the Department. Within two weeks from issuance of payment by the Department for busing costs, the Contractor shall submit proof that payment has been made to the MBTA. Failure of the contractor to provide proof of payment within the two week period will result in the following: (a) the removal of the prior payment from the subsequent estimate; and (b) all future payments will be made on a reimbursement basis, based upon the receipt of a cancelled check. The Department shall not pay any administrative charges associated with the costs of busing charged by the MBTA nor shall pay charges for debit accounts if such accounts are required by the MBTA.

The Contractor shall note that there are track outages currently scheduled on this Line for the Winthrop Avenue Bridge Replacement project in Revere, MassDOT Project No. 605528. The track outages are tentatively scheduled for the following weekends, and are subject to change:

Spring 2015

1st Weekend shutdown: 5/08/15 – 5/10/15

2nd Weekend shutdown: 5/15/15 – 5/18/15

Fall 2015

3rd Weekend shutdown: 11/06/15 – 11/08/15

4th Weekend shutdown: 11/13/15 – 11/16/15

The Contractor shall make every effort to schedule his work in a manner that utilizes one or more of these weekend shutdowns for work elements requiring track outages (specifically, the Washington Avenue Bridge demolition and steel erections).

MBTA COMMUTER RAIL

Keolis Commuter Service (KCS) operates the commuter rail for the MBTA. All references to MBTA in the provisions will mean Keolis Commuter Service (KCS).

MBTA/RAILROAD PERMITS AND LICENSES

The Contractor is advised to review the MBTA's website Doing Business with the MBTA's Development and Real Estate Department, <http://transitrealty.com/licenses/>. This website includes the MBTA Railroad Construction Specifications, Insurance requirements for Transit and Railroad, Special Instructions, Railroad and Transit Licenses, Trenching Policy and Crane requirements. The contractor shall follow all MBTA rules and regulations when performing work within the vicinity of the MBTA Commuter Rail East Route.

All information requested by the MBTA for Crane requirements (http://transitrealty.com/licenses/mbta_crane_requirements.pdf) will be submitted to the MBTA Safety Department for review including:

- A) Copy of Operator's Valid Driver's License
- B) Copy of Operator's Valid Massachusetts' Hoisting License
- C) Most recent Annual Third Party Inspection/Certification, must be within the last 12 Calendar months
- D) Specifications of the Crane
- E) Scope of Work
- F) Lifting Plan

The Contractor shall analyze construction crane loads to determine acceptable crane staging within the project work limits. Signed/Stamped approval of crane placement by MBTA/MassDOT is required within 14 days of Notice to Proceed.

PUBLIC SAFETY AND CONVENIENCE (Supplementing Subsection 7.09)

The Contractor shall perform the work in such a manner that the Massachusetts Bay Transportation Authority (Authority) and the operating Railroad (Keolis Commuter Services) can operate train service over the site with the following requirements:

1. Rail service is presently being operated on the existing tracks along portions of the work area of this Contract. It is the responsibility of the Contractor to make the necessary arrangements for performing all work specified herein within the time(s) allotted by the Authority and the operating Railroad and to assure that adequate protection for rail traffic is provided as necessary and/or as directed by the Authority. Timetable schedules for rail traffic shall be maintained at all times.

PUBLIC SAFETY AND CONVENIENCE (Continued)

2. All occupancy of track or that area within the clearance line of rail equipment by Contractor with either on-track or off-track equipment shall be under the exclusive control and jurisdiction of the Engineer. Prior to any construction activity, the Contractor shall appoint a representative, approved by the Authority, to become familiar with the operating rules, timetable and road characteristics of the operating railroad. All other employees of the Contractor shall be made familiar with the operating rules, timetable, and road characteristics by said representative. No Contractor employee shall be allowed to operate on and occupy any track without proper authorization issued by the Authority. Any unauthorized occupancy of track by the Contractor's employees, subcontractor, agents or others acting on behalf of the Contractor, shall not be tolerated and shall be sufficient cause to permit the Engineer to bar such Contractor's employees, or others, from the job.
3. The Commuter Rail Line operates 365 days per year. During normal weekdays, approximately 29 inbound, 29 outbound trains, and occasional freight trains operate on the Line. Track outages for the demolition and steel erection for the Washington Avenue Bridge will be limited to a total of five (5) outages. These outages can only occur during weekends between November 1st and the weekend prior to Memorial Day, and are granted by the Authority at their discretion. The outages will require bussing of passengers and it is the Contractor's responsibility to coordinate with the Authority and the Engineer for scheduling any outages. Bussing will be paid under a separate Force Account between the MassDOT Highway Division and the Authority.
4. The Authority may also run temporary single track operations through the work zone (i.e. the outbound track may be taken out of service during certain periods). The Contractor shall coordinate with the Authority and the Engineer in scheduling the single track operations, but should assume these can only occur during non-peak periods (typically 9:00 am to 4:00 pm, nights and weekends).
5. The workers employed by the Contractor or subcontractors who work within the MBTA property limits shall be required to attend a four (4) hour Railroad Worker Protection safety awareness class conducted by the operator Keolis. An administrative service cost will be charged per attendee and will be directly invoiced to the contractor by Keolis. The Contractor shall remit this fee to Keolis within thirty (30) days of said invoice. Recertification is required every year.
6. All work performed adjacent to the railroad tracks shall be performed under the direction of an Authority designated flagperson. The Contractor should expect delays for all construction activities that "foul" the operating track. The availability of flagpersons will be at the discretion of the Authority and the Authority reserves the right to delay or suspend the Contractor's access to the site because of operational requirements, adverse weather conditions or emergency track repairs. No additional compensation shall be made for delays resulting from railroad operations and the Contractor shall make allowances for this in his Bid Price. Flagpersons will be paid under a separate Force Account between the MassDOT Highway Division and the Authority.

LIMITATIONS OF OPERATIONS (Supplementing Subsection 8.06)

The Contractor is advised that all roads within the project limits are public roadways, and other than the closure depicted on the Temporary Traffic Management Plans and Detour Plans, the roadway shall remain open to local traffic throughout the duration of the Contract. During Contractor work hours and non-work hours, access to businesses and residences shall be maintained at all times, unless specified otherwise.

The Contractor shall keep Washington Avenue open to 2-way traffic during construction of initial Stage 1 work elements including installation of protective shielding, construction of new center pier foundation and stem, temporary fencing, utility vaults, and installation of temporary utilities. During this time, Washington Avenue may be narrowed to two 11-foot lanes and one sidewalk to facilitate and expedite the utility relocation work.

The Contractor shall also keep all existing traffic movements within the Arlington Street and Sixth Street intersection operational until such time as the Washington Avenue Bridge has attained full beneficial use & substantial completion (milestone #02).

Traffic lane closures on city roads will be subject to local authorities, local requirements, road opening permits and the Engineer's approval. City roads will not be closed unless prior approval from the City of Chelsea has been obtained.

The contractor shall erect the detour routes for any roadway closures prior to the beginning of construction on that roadway.

Parking for the Contractor's employees or its subcontractors' employees at any level is restricted to the storage/staging and work areas for this Contract.

Work on this Contract is in the vicinity of residential and commercial areas. All the equipment used on this Contract shall utilize noise suppressors for the duration of the Contract. Additionally, the Contractor shall abide by local ordinances and requirements concerning noise muffling or dampening to reduce disturbance. Refer to Item 850 Supplement Construction Noise Control for additional information.

The Contractor's attention is directed to the location of the work and the lack of available on-site areas for mobilization, staging and storage for the Contractor and his subcontractors. The Contractor may use areas within the project limits for staging and material lay-down. Off-site areas as necessary for Contractor parking, field offices, lay-down area, work storage and work staging areas shall be the responsibility of the Contractor. The Contractor shall notify the Engineer as to the location of all off-site staging and storage areas used for the project

SUBSECTION 8.10 DETERMINATION AND EXTENSION OF CONTRACT TIME FOR COMPLETION (TIME EXTENSIONS)

Replace this Subsection with the following:

A. General

It is an essential part of all contracts that Contractors shall perform the Work fully, entirely and in an acceptable manner within the contract duration.

The contract duration is based upon the requirements of public convenience and the assumption that the Contractor will prosecute the Work efficiently and with the least possible delay, in accordance with the maximum allowable working time, as specified in the Contract.

The contract duration has been carefully considered and has been established for reasons of importance to the Department. The contract duration will be enforced and it is understood that the Contractor accepted this concept at the time of the submission of the bid. The timing of the Notice to Proceed (NTP) has been taken into account in the determination of the contract duration and the timing of the issuance of the NTP shall not, by itself, be a reason for a time extension.

An extension of contract time will be granted only if entitlement to a time extension has been clearly demonstrated to the satisfaction of the Engineer by a documented time entitlement analysis, performed in accordance with the requirements of Subsection 8.02.E.8 - Time Entitlement Analysis.

B. Requests for Additional Contract Time (Time Extensions)

In response to a request for a time extension, an extension of contract time may be granted for demonstrated delays resulting from only one, or, in the case of concurrent delays, a combination of the following causes:

1. Extra Work

Each extra work order (EWO) proposal shall include an evaluation of the impact of the EWO on contract time, expressed in calendar days. If there is no impact to the contract time as a result of the EWO, the EWO shall indicate this by stating that zero (0) calendar days of additional time is being requested. The need for a time extension as a result of the EWO must be clearly demonstrated by a documented time entitlement analysis (TEA) performed by the Contractor in accordance with the requirements of Subsection 8.02.E.8. A documented preliminary TEA supporting the EWO proposal shall be submitted to the Engineer as part of the EWO proposal. Also see Subsection 4.03 – Extra Work and Subsection 4.05 – Validity of Extra Work.

SUBSECTION 8.10 (Continued)**2. Department-Caused Delays**

If any part of the Work is delayed or suspended by the Department, the Contractor will be granted a time extension to complete the Work or any portion of the Work only if entitlement to this time extension has been clearly demonstrated by a documented time entitlement analysis. Department-caused delays shall not include delays to or suspensions of the Work that result from the fault or negligence of the Contractor. Also see Subsection 8.05 – Claim for Delay or Suspension of the Work.

3. Increased Quantities

Increased quantities of work may be considered as the basis for a time extension only if the requirements of Subsection 4.06 - Increased or Decreased Contract Quantities are met. The time allowed for performance of the Work will be increased based on increased quantities only if entitlement to this time extension has been clearly demonstrated by a documented time entitlement analysis. A decrease in quantities shall also require a time entitlement analysis to determine if a deduction of contract time is warranted.

4. Delays Not Caused by Contractor Fault or Negligence

When delays occur due to reasonable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to: “Acts of God”; war, whether or not declared, civil war, insurrection, rebellion or revolution, or to any act or condition incident to any of the foregoing; acts of the Government; acts of the State or any political subdivision thereof; acts of other contracting parties over whose acts the Contractor has no control; fires; floods; epidemics; abnormal tides (not including Spring tides); severe coastal storms accompanied by high winds or abnormal tides; freezing of streams and harbors; abnormal time of Winter freezing or Spring thawing; interference from recreational boat traffic; use of beaches and recreational facilities for recreational purposes during the Summer season; abnormal ship docking and berthing; unanticipated use of wharves and storage sheds; strikes, except those caused by improper acts or omissions of the Contractor; extraordinary delays in delivery of materials caused by strikes, lockouts, wrecks, and/or freight embargoes; a time extension will be granted only if entitlement to a time extension has been clearly demonstrated by a documented time entitlement analysis.

An “Act of God” as used in this subsection is construed to mean an earthquake, flood, cyclone, hurricane, tornado, or other cataclysmic phenomenon of nature beyond the power of the Contractor to foresee and/or make preparations against. Additional consideration may be given to severe, abnormal flooding in local rivers and streams that has been reported as such by the National Weather Service. Rain, wind, snow, and/or other natural phenomena of normal intensity, based on National Weather Service reports, for the particular locality and for the particular season of the year in which the Work is being prosecuted, shall not be construed as an “Act of God” and no time extension will be granted for the delays resulting therefrom.

Within the scope of acts of the Government, consideration will be given to properly documented evidence that the Contractor has been delayed in obtaining any material or class of labor because of any assignment of preference ratings by the Federal Government or its agencies to defense contracts of any type.

SUBSECTION 8.10 (Continued)

5. Delays Caused by Public Service Corporations, Municipal Departments or Other Third Parties
If any part of the Work is delayed by public service corporations, municipal departments or other third parties, a time extension will be granted only if entitlement to a time extension has been clearly demonstrated by a documented time entitlement analysis. Also see Subsections 5.05 - Cooperation by Contractor, 5.06 - Adjacent Contracts and 8.04 - Removal or Demolition of Buildings and Land Takings.

C. Time Extension Determination

1. When the Contractor submits a request for a time extension, placing the Department on notice of a delay due to any of the causes listed in Subsection 8.10.B, it shall be submitted in writing to the Engineer within fifteen (15) calendar days after the start of the delay. No time extension will be granted if a request for a time extension is not filed within fifteen (15) calendar days after the start of the delay.

A documented preliminary time entitlement analysis (TEA) supporting the request for a time extension and meeting the requirements of Subsection 8.02.E.8 shall be submitted to the Engineer no later than fifteen (15) calendar days after the request for a time extension is submitted to the Engineer or thirty (30) calendar days after the start of the delay. A documented final TEA shall be submitted to the Engineer no later than fifteen (15) calendar days after the end of the delay. During the time between the preliminary and final TEAs, the delay shall be documented in statused contract progress schedules submitted in accordance with the requirements of Subsection 8.02.E.5.

2. No time extension will be granted for any delay or any suspension of the Work due to the fault of the Contractor.

3. No time extension will be granted if the request for a time extension is based on any claim that the originally established contract duration was inadequate.

4. Time extensions will only be granted for delays, including concurrent delays, to activities affecting contract milestones, the contract completion date and/or other critical path activities as demonstrated to the satisfaction of the Engineer by a detailed time entitlement analysis that clearly states the number of calendar days of extra time being requested.

5. The probable slowdown or curtailment of work during inclement weather and winter months has been taken into consideration in determining the contract duration and therefore no time extension will be granted, except as defined in Subsection 8.10.B.4.

6. Any work restriction related to weather, permit conditions, community accommodation, traffic or any other restriction specified in the Contract or reasonably expected for the particular locality and for the particular season of the year in which the Work is being prosecuted must be considered in the analysis of each individual time extension and shall not be considered, in itself, justification for an extension of time.

SUBSECTION 8.10 (Continued)

7. Any time entitlement analysis prepared for the purpose of requesting a time extension shall clearly indicate any proposed overtime hours or additional shifts that are incorporated in the schedule. The Engineer shall have final approval over the use of overtime hours and additional shifts and shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of time extensions if it is determined to be in best interest of the Department to do so.

D. Disputes

Any dispute regarding whether or not a time entitlement analysis demonstrates entitlement to a time extension, the number of days granted in a time extension or any other question of fact arising under this subsection shall be determined by the Engineer.

The Contractor may dispute a determination by the Engineer by filing a claim notice within fourteen (14) calendar days after the Contractor's request for additional time has been denied or if the Contractor does not accept the number of days granted in a time extension. The Contractor's claim notice shall include a time entitlement analysis that sufficiently explains the basis of the time-related claim. Failure to submit the required time entitlement analysis with the claim notice shall result in denial of the Contractor's claim.

SUBSECTION 4.03 EXTRA WORK (Also see Subsection 4.05)

The Contractor shall do any work not herein otherwise provided for when and as ordered in writing by the Engineer, such written order to contain particular reference to this Subsection and to designate the work to be done as Extra Work.

Unless specifically noted in the Extra Work Order, Extra Work will not extend the time of completion of the Contract as stipulated in Subsection 8.10.

The determination of the Engineer shall be final upon all questions concerning the amount and value of Extra Work (except as provided in Subsection 7.16).

Payment for Extra Work will be provided in Subsection 9.03.

DESIGNER/PROJECT MANAGER**DESIGNER**

AECOM Technical Services
Francis J. Astone, P.E.
(978) 905-2173

PROJECT MANAGER

MassDOT
Joseph A. Pavao, Jr., P.E., Project Manager
857-368-9287

SUBLETTING OR ASSIGNMENT OF CONTRACT

(Supplementing Subsection 8.01)

The following items are designated as specialty items for this Contract:

ITEM 745.01	BUS RAPID TRANSIT STATIONS	LUMP SUM
ITEM 745.02	MBTA INSPECTOR'S BOOTH	LUMP SUM
ITEM 746.01	MBTA TEMPORARY COMFORT STATION	LUMP SUM

MBTA AUTOMATIC FARE VENDING EQUIPMENT

Contractor shall purchase MBTA Automatic Fare Vending Equipment to be installed at the Proposed Bus Rapid Transit (BRT) Stations along the Silver Line Gateway Project in Chelsea.

The equipment and work shall conform to the applicable provisions of the MBTA Specifications included in the Appendices of these Special Provisions.

The Contractor shall coordinate and make all arrangements with the MBTA Automated Fare Collection (AFC) Department for the purchasing of the equipment from the AFC equipment manufacturer Scheidt & Bachmann.

The Contractor will be reimbursed for the actual costs incurred for purchasing the MBTA Automated Fare Vending Equipment.

Within two weeks from issuance of payment by the Department for the equipment, the Contractor shall submit proof that payment has been made to the MBTA/Scheidt & Bachmann. Failure of the Contractor to provide proof of payment within the two week period will result in the following: (a) the removal of the prior payment from the subsequent estimate; and (b) all future payments will be made on a reimbursement basis, based upon the receipt of a cancelled check.

The Department will not pay any administrative charges associated with the costs of purchasing the equipment nor pay charges for debit accounts if such accounts are required. No additional compensation will be made for MBTA coordination.

Installation of the Fare Vending Equipment shall be as indicated in the MBTA Supplemental Specifications Section 10450 included as Appendix A to these Special Provisions.

RODENT CONTROL

The rodent control work shall consist of the control (extermination) of rodents both prior to and during construction activities in areas designated by the Engineer.

The work shall conform to the applicable provisions of Section 119 of the Standard Specifications and these Special Provisions.

QUALITY CONTROL

Exterminator Qualifications: Exterminators must hold a current license issued by the Massachusetts Pesticide Board.

Employ servicemen for work on this Contract, each having experience in rodent control procedures.

SUBMITTALS

Submit rodent control procedures, indicating material, quantity, methods, and time schedule for extermination.

Ten days prior to commencement of rodent control procedures, furnish name of rodent control licensed exterminator, date of initial rodenticide application, and methods and materials to be employed.

Manufacturer's printed application instructions for the approved toxicants.

Bi-weekly individual reports on activities, including location of sites treated, amount and types of rodenticides used during the month, and determinable results of the program.

PROSECUTION OF WORK

Application

Apply materials in strict accordance with EPA approved label directions and the Rules and Regulations of the Massachusetts Pesticide Board.

Maintain accurate records of placement, type, and volume of rodent baits applied.

CLEANUP

Remove carcasses daily and dispose of properly according to law.

Upon completion of operations at site, remove remaining exposed bait or anticoagulant packages and dispose of properly according to law.

RODENT CONTROL (Continued)**COMPENSATION**

The Contractor will be reimbursed for the actual costs incurred for Rodent Control:

- Before permitting rodent control work to begin, the Contractor shall request an itemized written estimate of cost from two or more private firms, for the work to be performed.
- Compensation will be based upon receipted invoices and signed receipts, without charges for Contractor overhead and profit.
- The Contractor shall submit receipted copies of itemized invoices for such work to the Engineer. Within two weeks from issuance of payment by the Department for rodent control costs, the Contractor shall submit proof that payment has been made to the private rodent control company.
- The Department will not pay any administrative charges associated with these costs.

NSTAR HIGH TENSION LINE RELOCATION

NSTAR will relocate the existing high-tension electric lines along the Silver Line Gateway Project in Chelsea.

The work under this Item shall conform to the applicable provisions of the MBTA Specifications included in includes, but is not limited to, design of the relocated system, procuring new steel poles and appurtenances, installation of new foundations and poles, cutover of existing wires, and removal of existing poles.

The Contractor shall be solely responsible for coordinating his work with NSTAR in performing the work under this item. No additional compensation or contract time will be granted to the Contractor for this effort.

COMPENSATION

Compensation to NSTAR for the work required will be paid to the Contractor for actual costs incurred including all necessary materials labor and equipment to complete the work.

The Department will reimburse the Contractor for all costs incurred.

Within two weeks from issuance of payment by the Department for the equipment, the Contractor shall submit proof that payment has been made to NSTAR. Failure of the Contractor to provide proof of payment within the two week period will result in the following: (a) the removal of the prior payment from the subsequent estimate; and (b) all future payments will be made on a reimbursement basis, based upon the receipt of a cancelled check.

The Department will not pay the Contractor for any administrative or coordination costs associated with the NSTAR work to relocate the high tension lines.

RAILROAD FLAGGING

The Contractor will be reimbursed for the actual costs incurred for Railroad Flagging:

The work under this Item shall conform to the applicable provisions of the MBTA Specifications included in Document A00804 - Appendix B of these Special Provisions.

The Contractor shall make all arrangements with the appropriate Railroad for Railroad employees required for flagging and protective services on account of the operations of the Contractor. The Contractor shall notify the Railroad 72 hours prior to the need of such services.

COMPENSATION

Compensation for Railroad Flagging will be paid to the Contractor for actual costs incurred for flagging services provided by the MBTA and their Commuter Rail Operators, Keolis Commuter Services.

The Department will reimburse the Contractor for all flagging costs approved by the Engineer.

Within two weeks from issuance of payment by the Department for flagging, the Contractor shall submit proof that payment has been made to the MBTA. Failure of the contractor to provide proof of payment within the two week period will result in the following: (a) the removal of the prior payment from the subsequent estimate; and (b) all future payments will be made on a reimbursement basis, based upon the receipt of a cancelled check. The Department shall not pay any administrative charges associated with the costs of flagging charged by the MBTA nor shall pay charges for debit accounts if such accounts are required by the MBTA.

No additional compensation will be made for MBTA coordination.

ITEM 100. SCHEDULE OF OPERATIONS – FIXED PRICE \$200000 LUMP SUM

The work under this item shall conform to the relevant provisions of Section 8.00 and Subsection 8.02 of the Standard Specifications, replaced as follows, the Plans, and the following:

8.02 Schedule of Operations - Type 2 (\$10,000,001 - \$50,000,000)**A. General Requirements**

For Definition of Terms, see Subsection 8.02.B.

This Contract requires that a schedule control program be instituted by the Contractor to create a construction schedule that tracks and documents the progress of the Work from Notice to Proceed (NTP) through Final Acceptance.

This program requires the following schedule submittals to be made by the Contractor:

- Preliminary Schedule (first 120 Calendar Days after NTP)
- Contract Progress Schedules
- Short-Term Construction Schedules
- Summary Contract Progress Schedules
- Time Entitlement Analyses
- Recovery Schedules

The Contractor shall use computer software capable of preparing, statusing and revising Critical Path Method (CPM) schedules using precedence diagramming methods as approved by the Engineer.

The software shall be capable of printing activity reports and plotting CPM time-scaled logic diagrams, both of which shall be sortable by structures, facilities, subcontractors, submittals, deliveries, extra work orders and any other critical features of the Contract.

Within seven (7) Calendar Days after NTP, the Contractor shall submit to the Engineer sufficient information demonstrating that the CPM software it proposes to use on the Contract is fully capable of producing the specified schedules and tracking tools. The Engineer shall notify the Contractor in writing within seven (7) Calendar Days after receipt of the Contractor's notification on software (within fourteen (14) Calendar Days after NTP) if there are any objections to the CPM software selected.

The Basis of Payment for this work is shown in Subsection 8.02.F.

ITEM 100. (Continued)**B. Definition of Terms**

Activity - An element in the Contract Progress Schedule describing a discrete part of the Work and establishing the time required for completing that part of the Work.

Baseline Contract Progress Schedule - The initial version of the Contract Progress Schedule, accepted by the Department, with or without comments, and showing the Contractor's plan for completion of the Work within the Contract Time in effect at the start of the Contract.

Calendar Day - Any day of the year, regardless of whether or not work is performed by the Contractor, which day of the week on which it falls, or whether or not it is a holiday.

Critical Path - Any continuous sequence of activities in the Contract Progress Schedule that controls achievement of a Contract Milestone and/or the Contract Completion Date.

Construction Schedule - The Schedule which shows the Contractor's approach to planning, scheduling, and execution of the Work, referred to herein as the Contract Progress Schedule.

Contract Milestone - A Contract Milestone is a significant and key instant of time with a zero (0) duration that highlights progress made on the project. Contract Milestones are specified in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents.

Contract Progress Meeting - A weekly or every other week schedule meeting to review the progress on the Short-Term Construction Schedule, including, but not limited to, the actual completion percentage, a comparison of actual dates with early dates, and any additional information deemed pertinent for a full and complete discussion of the Short-Term Construction Schedule. See also Subsection 8.02.E.6.

Contract Progress Schedule - The Contract Progress Schedule shows how the Work is to be completed from Notice to Proceed through Final Acceptance. Contract Progress Schedules may be Baseline, Revised, or Stated versions. See also Subsections 8.02.E.3 through 8.02.E.5.

Contract Progress Schedule of Record - The Contract Progress Schedule of Record is the latest Contract Progress Schedule accepted by the Engineer and is the official schedule of the project.

CQE - Contract Quantity Estimate or pay estimate that occurs every two (2) weeks. Also known as the progress payment.

CPM - Critical Path Method is a computerized construction project planning and scheduling process where a construction project schedule's critical path is the longest chain or path of activities leading to project completion.

Delays - Any slippage of the Early Dates in the Contract Progress Schedule which forecast a slippage in the Contract Milestone and/or the Contract Completion Date.

Early Completion Schedule - A CPM schedule showing completion of the Work ahead of the Contract Completion Date specified in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents.

ITEM 100. (Continued)

Early and Late Dates - Early start or completion times and late start or completion times for the performance of activities in the Contract Progress Schedule.

Extra Work Order. A Contract Modification adding money and associated necessary time to the Contract. See also Subsection 8.10.B.1.

Final Acceptance - Full and complete satisfaction of the Contract Requirements, consisting of completion and acceptance of all physical work and submission and acceptance of all contractually-required reports and other documentation. See also Subsection 5.11.

Float - Float shall be defined as the amount of time between when an activity can start or finish (Early Start or Early Finish Date) and when an activity must start or finish (Late Start or Finish Date.) Float is further defined as the amount of time any given activity or path of activities may be delayed before it will affect the Contract Time. Float belongs to the project and is a shared commodity between the Department and the Contractor and is not for the exclusive use or benefit of either party. Either party has full use of the float until it is depleted. The float may be claimed by whichever party first demonstrates a need for it, i.e., that any activities on the critical path, where float equals zero, any Contract Milestones and/or the Contract Completion Date have been delayed. The Contractor shall demonstrate this need in a Time Entitlement Analysis meeting the requirements of Subsection 8.02.E.8.

Fragnet - a mini-schedule or sub-network containing a logically-linked group of activities or durations that illustrate a distinct event or period of time in the Contract Progress Schedule. Fragnets are typically used as the schedule portion of a Time Entitlement Analysis (TEA) and are required to be submitted as part of a TEA. See also Subsection 8.02.E.8.

Logic Diagram - A logic diagram is a type of construction project schedule that shows the progression of the work as a network where activities are linked by arrows with the tail of the arrow connected to the predecessor activity and the head of the arrow connected to the successor activity. Logic diagrams may be either time-scaled or non-time-scaled.

NTP - Notice to Proceed. A letter sent to a contractor after Contract Award by the Director of Contracts and Records containing the contractual start and completion dates. The date of this letter is referred to as the NTP Date.

Pay Estimate - See CQE.

Preliminary Schedule - The Preliminary Schedule is a summary-level Contract Progress Schedule that shows how the Contractor plans to perform the Work for the first one hundred and twenty (120) Calendar Days of the Contract on a detailed basis and how it plans to perform the remaining portion of the Work from Notice to Proceed to Final Acceptance on a less-detailed basis. See also Subsection 8.02.D.

Recovery Schedule - A Recovery Schedule is a detailed Revised Contract Progress Schedule that changes the Contract Progress Schedule of Record to show how the Contractor plans to recover from or make up the contract time lost on the project's critical path due to a delay. See also Subsection 8.02.E.9.

ITEM 100. (Continued)

Revised Contract Progress Schedule - A Revised Contract Progress Schedule incorporates activities, logic ties, and relationships added to or deleted from the Contract Progress Schedule of Record based on a Time Entitlement Analysis accepted by the Engineer. See also Subsections 8.02.E.4 and 8.02.E.8.

Short-Term Construction Schedule - A Short-Term Construction Schedule details the daily work activities for a thirty-five (35) Calendar Day period, the two (2) weeks prior to the Contract Progress Meeting and the three (3) weeks following the meeting in a bar chart format. The daily activities shall correspond to the Contract Progress Schedule activities, but shall be at a greater level of detail. See also Subsection 8.02.E.6.

Stated Contract Progress Schedule - A Stated Contract Progress Schedule is a monthly update of the Contract Progress Schedule of Record. See also Subsection 8.02.E.5.

Substantial Completion - Substantial Completion occurs when either the Work has been completed except for work having a Contract Price of less than one (1) percent of the adjusted Total Contract Price or substantially all of the Work has been completed and opened to public use, except for minor incomplete or unsatisfactory work items that do not materially impair the usefulness of the Work. See also Subsection 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes.

Summary Contract Progress Schedule - A Summary Contract Progress Schedule is a separate and distinct schedule based upon the internal coding of the Contract Progress Schedule. This coding shall allow a summary-level Contract Progress Schedule to be produced that identifies major physical classes, structures, facilities, and/or other elements of the Work as discussed in Subsection 8.02.E.1. See also Subsection 8.02.E.7.

Time Entitlement Analysis (TEA) - A method of schedule delay analysis that shows the impacts of a particular delay by arranging the affected activities in a timeline of when the delay occurred. This allows the effect of a particular event or delay to be determined and illustrated. Fragnets are typically used as the schedule portion of a Time Entitlement Analysis (TEA) and are required to be submitted as part of a TEA. See also Subsection 8.02.E.8.

Work Day - Any day of the week on which work is performed by the Contractor, including Saturdays and Sundays, but excluding holidays observed by the Contractor.

C. Schedule Reviews

The Engineer will respond to each schedule submittal within fifteen (15) Calendar Days of receipt providing comments and disposition that either accepts the schedule or requires revision and resubmittal.

Schedules shall be resubmitted within fifteen (15) Calendar Days after receipt of the Engineer's comments.

ITEM 100. (Continued)

The Engineer's comments will address whether items of the Work have been omitted, if activity durations are reasonable or that the means, methods, timing and/or sequencing of the Work are practicable. The planning, scheduling, and execution of the Work and the accuracy of their representation in the Contract Progress Schedule shall remain the sole responsibility of the Contractor.

The Contractor shall not be relieved from its responsibility for satisfactorily completing the Work within the specified Contract Time due to its failure to submit an acceptable Contract Progress Schedule.

Failure to submit schedules as and when required could result in the withholding of full or partial pay estimate payments by the Engineer.

D. Preliminary Schedule

The Preliminary Schedule shall be submitted to the Engineer within twenty-one (21) Calendar Days after Notice to Proceed.

The Preliminary Schedule shall be a summary-level Contract Progress Schedule that shows the Work being completed in accordance with the Contract Milestones contained in Subsection 8.03 – Prosecution of Work or elsewhere in the Contract Documents. It shall incorporate the Contractor's detailed work activities for the first one hundred and twenty (120) Calendar Days of the Contract. The portion of the Preliminary Schedule addressing the remainder of the Work shall be in sufficient detail and content, including logic ties and durations, to show the Contractor's general plan for completion of the Work in accordance with the Contract Milestones.

At a minimum, the Preliminary Schedule, as well as all subsequent schedules described in Subsection 8.02.E, shall clearly define the progression of the Work from Notice to Proceed to Final Acceptance by using separate activities for each of the following items:

- 1) Notice to Proceed
- 2) Each component of the Work
- 3) Procurement of permit modifications by the Contractor or the Engineer
- 4) The preparation and submission of shop drawings and other required submittals, the duration of which shall be determined by the Contractor
- 5) The review and return of shop drawings and other required submittals, the duration of which shall be a minimum of thirty (30) Calendar Days, unless otherwise approved by the Engineer

ITEM 100. (Continued)

- 6) Items to be paid, such as, engineering work, permanent materials and equipment (material on hand), such as unfabricated structural steel (raw materials), equipment procurement, and equipment delivery to the site or storage location
- 7) Interfaces with adjacent work, utility companies, other public agencies, sensitive abutters, and/or any other third party work affecting this Contract
- 8) Interim Milestones listed in Subsection 8.03 - Prosecution of Work or elsewhere in the Contract Documents
- 9) The critical path, clearly defined and labeled
- 10) Float shall be clearly identified as defined in Subsection 8.02.B
- 11) Substantial Completion per the requirements of Subsection 7.15 - Claims Against Contractors for Payment of Labor, Materials and Other Purposes
- 12) Punchlist Completion Period
- 13) Physical Completion per the requirements of Subsection 5.11 - Final Acceptance
- 14) Documentation Completion per the requirements of Subsection 5.11 - Final Acceptance
- 15) Final Acceptance per the requirements of Subsection 5.11 - Final Acceptance

The work activities identified for the first one hundred and twenty (120) Days shall be in sufficient detail to support the pay estimate for that period, including all activities which the Contractor is required to perform or plans to perform and for which the Contractor intends to receive payment as specified in Subsection 9.01 – Measurement of Quantities.

The Preliminary Schedule shall be prepared and submitted in accordance with Subsections 8.02.E.1 and 8.02.E.2.

The Preliminary Schedule shall be valid for one hundred and twenty (120) Calendar Days after Notice to Proceed. The Preliminary Schedule will be superseded and replaced by the Baseline Contract Progress Schedule following its acceptance by the Engineer. If the Baseline Contract Progress Schedule not be accepted by the Engineer within one hundred and twenty (120) Calendar Days after Notice to Proceed, the Contractor shall revise the Preliminary Schedule to include the additional work activities that have occurred during the time period that has elapsed after the previous time period of one hundred and twenty (120) Calendar Days after Notice to Proceed, status the schedule as required by Subsection 8.02.E.5 and resubmit it no less than every two (2) weeks until the Baseline Contract Progress Schedule is accepted by the Engineer. This revised, statused Preliminary Schedule shall be called the Statused Preliminary Schedule. For Baseline Contract Progress Schedule requirements, see Subsection 8.02.E.3.

No pay estimate shall be approved by the Engineer until the Preliminary Schedule has been submitted to the Engineer, unless otherwise agreed to by the Engineer.

ITEM 100. (Continued)**E. Contract Progress Schedules****1. Requirements for all Contract Progress Schedules**

All Contract Progress Schedules listed in Subsection 8.02.A and described in Subsections 8.02.E.3 through 8.02.E.9 shall fully conform to the following requirements:

- a. **LOGIC:** The Contract Progress Schedule shall divide the Work into activities with appropriate logic ties, to show; (i) the Contractor's overall approach to the planning, scheduling and execution of the Work, (ii) consistency with the requirements of this Subsection, (iii) the Contractor's approach to conformance with any sequences of Work required by the Contract Documents, including, but not limited to, Subsection 8.03 - Prosecution of Work and Subsection 8.06 – Limitations of Operations.
- b. **ACTIVITIES:** The Contract Progress Schedule shall clearly and separately define the progression of Work from Notice to Proceed to Final Acceptance by using separate activities as described in Subsection 8.02.D.
- c. **EARLY AND LATE DATES:** Early Dates consist of Early Start and Early Finish dates. The Early Start date is the earliest date an activity can start or commence. The Early Finish date is the earliest date an activity can finish or be completed. Late Dates consist of Late Start and Late Finish dates. The Late Start date is the latest date an activity can start without delaying or lengthening the duration of the project. The Late Finish date is the latest date an activity can finish or be completed without delaying or lengthening the duration of the project.
- d. **DURATIONS:** Activity durations shall be in Work Days. Durations shall be regulated by a work breakdown structure (WBS) of physical elements of the Work determined by work discipline, station number, or structure, which reflect the time the Contractor and/or Subcontractors require to perform the related work.
- e. **ITEMS TO BE PAID:** The Contractor shall specifically identify in the Contract Progress Schedule all items of permanent materials and equipment (Materials On Hand) for which the Contractor intends to request payment, in accordance with Subsection 9.04 - Partial Payments, prior to the incorporation of such items into the Work.
- f. **ACTIVITY DESCRIPTIONS:** The Contractor shall use standard activity descriptions in all Contract Progress Schedules that clearly describe the work to be performed using a combination of words, structure numbers, station numbers, bid item numbers, work breakdown structure (WBS) and/or elevations in a concise and compact label.

ITEM 100. (Continued)

- g. **ACTIVITY IDENTIFICATION NUMBERS:** The Contractor shall use the standard activity identification numbering system specified below for all activities in all Contract Progress Schedules:

C# # # # # - # # #

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+ - - - - Contract Number

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|
+ - - - - Sequential Numbering Code

- **Contract Number** - The first seven (7) characters of the activity identification number shall consist of a “C” for Contract followed by the five (5) digit Department contract number and ended with a dash.
 - **Sequential Numbering Code** - The second set of characters in the activity identification number, the actual number of characters to be determined by the Contractor, shall consist of a sequential numbering system created by the Contractor denoting work breakdown structure (WBS), locations, station numbers, major areas of construction, structure types, structure designations, class of work, type of activity, bid item number, milestone number, phase of the Work and/or any other type of information that the Contractor wishes to include in its activity identification numbering code.
- h. **ACTIVITY CODES:** The Contractor shall use all of the following sortable standard activity codes in all Contract Progress Schedules:

Code	Code Designation
DIST	MassDOT Highway Division District Number
TOWN	City / Town Name
MSNO	Contract Milestone Number Designation
BIDI	Bid Item Number Designation
STRUC	Type of Structure Designation
RESP	Organization Responsibility Code
OTHR	Other Field
PHAS	Phase of the Work or of the Construction Schedule

DIST – MassDOT Highway Division District Number: A one-digit code corresponding to the MassDOT Highway Division District in which the project is located:

1	MassDOT Highway Division District 1
2	MassDOT Highway Division District 2
3	MassDOT Highway Division District 3
4	MassDOT Highway Division District 4

ITEM 100. (Continued)

5	MassDOT Highway Division District 5
6	MassDOT Highway Division District 6
S	MassDOT Highway Division Statewide

TOWN – City / Town Name: A four (4) letter code using the first four letters of the name of the city or town in which the project is located.

Example:

MANS	Mansfield
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MSNO – Contract Milestone Number Designation: A two (2) digit code corresponding to the Contract Milestone number contained in Subsection 8.03 - Prosecution of Work that is at the end of the activity's sequence chain.

Example:

03	Milestone No. 3 – Substantial Completion
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BIDI – Bid Item Number Designation: A seven (7) digit code corresponding exactly, including periods and spaces, to the bid item number with which the activity is associated.

Example:

975.3	Metal Bridge Railing
PCM	Activity added by Proposal or Contract Modification

PROJ – Primary Project Type: A one (1) or two (2) letter code corresponding to the primary project type or type of structure as shown below. Additional codes may be added by the Contractor as approved by the Engineer.

BC	Bridge Modification or Rehabilitation
BN	Bridge New
BR	Bridge Replacement
BP	Bike Path
CB	Catch Basin
D	Demolition
H	Highway Reconstruction (local road or state highway)
HI	Highway Reconstruction (interstate highway)
P	Painting
R	Resurfacing
S	Surfacing
TS	Traffic Signals
TU	Tunnels
U	Utilities
V	Vertical Construction (Chapter 149)

ITEM 100. (Continued)

RESP – Organization Responsibility Code: A one (1) to five (5) digit code corresponding to the initials of the organization responsible for performing the work contained in the activity. Examples of this coding are:

MIW	McGrath Iron Works
BCEC	Bay City Electric Company
MBTA	Massachusetts Bay Transportation Authority
CSX	CSX Railroad Corporation
MDOT	Massachusetts Department of Transportation Highway Division

OTHR – Other Field: A seven (7) digit code reserved for the exclusive use of the Engineer as required for coding miscellaneous items such as contract modifications, submittal activities, time and material work, force account work, or other category of work activity that may prove to need such coding during the progress of the Work.

XXX A description of something other than the above.

- i. **CALENDARS:** Different calendars may be created and assigned globally, i.e., applying to all activities, or individually to each activity. Calendars define the available hours of work in each Calendar Day, Holidays and general or project-specific non-Work Days. Examples of non-Work Days include, but are not limited to:
 - Winter Shutdown Period: December 1 thru March 15. This may be optional depending on any requirements that may be stated elsewhere in this Contract.
 - Peak traffic hours on heavily traveled roadways
 - Special requirements by sensitive abutters, railroads, utilities and/or other state agencies.
 - Cape Cod Summer Roadway Work Restrictions: While these restrictions may be project-specific based on such factors as the exact location of the project, whether or not the roadway involved has a high traffic volume and/or is a main route, its proximity to beaches and other popular tourist attractions, and its overall impacts on traffic and tourism, they are generally enforced between Memorial Day and Labor Day, unless otherwise directed by the Engineer.
 - Cape Ann Summer Roadway Work Restrictions: While there are no general restrictions for Cape Ann as there are for Cape Cod, project-specific restrictions may be enforced based on the same factors listed above for Cape Cod.
 - Turtle and Fish Migration Periods and/or other in-water work restrictions: Project-specific
 - Working over Waterways Restricted Periods: Project-specific
 - Night-time paving and striping operations temperature restrictions: Project-specific

ITEM 100. (Continued)

j. NOT TO BE USED: Unspecified milestones or constrained dates, scheduled work not required for the accomplishment of a Contract Milestone, use of activity durations, logic ties and/or sequences deemed unreasonable by the Engineer, delayed starts of follow-on trades, or use of float suppression techniques contrary to the provisions of Subsection 8.05 – Claim for Delay or Suspension of the Work shall not be used in the Contractor's Progress Schedule.

k. FLOAT: See Subsection 8.02.B.

l. THIS SECTION NOT USED.

2. Contract Progress Schedule Reporting and Submittal Requirements

All Contract Progress Schedules listed in Subsection 8.02.A and described in Subsections 8.02.E.3 through 8.02.E.9 shall be prepared and submitted in accordance with the requirements listed below.

Each Contract Progress Schedule submittal shall be uniquely identified.

Contract Progress Schedules shall be prepared using the computerized construction scheduling software described in Subsection 8.02.A and approved by the Engineer.

All Contract Progress Schedule submittals shall include each of the following documents, prepared in two formats; copied to three (3) compact discs (CD) and three (3) copies plotted on paper, for distribution as follows: one (1) copy each for the Boston Construction, District Construction and Resident Engineer's Offices:

a. Narratives

A Narrative is a written description of the schedule that shall:

- (i) itemize and describe the flow of work for all activities on the Critical Path;
- (ii) compare Early and Late Dates for activities on the Critical Path;
- (iii) show progress highlights and quantify Work Days gained or lost versus the Contract Progress Schedule of Record;
- (iv) describe the Contractor's plan, approach, methodologies, and resources to be employed for completing the various operations and elements of the Work;
- (vi) itemize shifts, Holidays, and if multiple calendars are applied to the activities, uniquely identify each calendar.

ITEM 100. (Continued)**b. Bar Charts**

Time scaled bar charts shall be prepared using a scale that yields readable plots and that meet the requirements of Subsection 8.02.E.1. Activities shall be linked by logic ties and shown on the Early Dates. Critical paths shall be highlighted and Total Float shall be shown for all activities. The paper plots of schedule Bar Charts shall be as follows:

24" X 36"-sized paper shall be used for Baseline Schedules, Revised Contract Progress Schedules and Recovery Schedules;

11" X 17" - sized paper shall be used for all other schedule types and Time Entitlement Analyses. These may be submitted as a .pdf file, if approved by the Engineer.

c. Time scaled Logic Diagrams

Time scaled logic diagrams shall be prepared using a scale that yields readable plots and that meet the requirements of Subsection 8.02.E.1. Activities shall be linked by logic ties and be shown on the Early Dates. Critical paths shall be highlighted and Total Float shall be shown for all activities. Paper plots of time-scaled logic diagrams shall be submitted as stated in Subsection 8.02.E.2.b - Bar Charts

d. Detailed Activity Schedule Comparisons

A Detailed Activity Schedule Comparison is a simple reporting tool in the format of a graphical report that will provide Resident Engineers with immediate, timely and up-to-date information. The Detailed Activity Schedule Comparison consists of an updated bar chart that overlays the previous time period's bar chart for an easily-read comparison of progress during the present and previous reporting periods. Simple instructions for creating Detailed Activity Schedule Comparisons appear on the MassDOT Highway Division website at: <http://www.massdot.state.ma.us/Highway/>

e. THIS SECTION NOT USED.

f. THIS SECTION NOT USED.

g. THIS SECTION NOT USED.

3. Baseline Contract Progress Schedule

The Baseline Contract Progress Schedule shall be due seventy-five (75) calendar days after Notice to Proceed. The Baseline Contract Progress Schedule shall only reflect the Work awarded to the Contractor and shall not include any additional work involving extra work orders or any other type of alleged delay.

The Baseline Contract Progress Schedule shall include all activities and content contained in the Preliminary Progress Schedule for the first one hundred and twenty (120) Calendar Days after NTP. Variations from the durations, logic, and work plan identified in the Preliminary Progress Schedule shall be limited to correction of errors in logic and/or addition of detail. All changes shall be clearly highlighted and identified and explained and justified in writing as part of the Contract Progress Schedule Narrative required in Subsection 8.02.E.2.a.

ITEM 100. (Continued)

The Baseline Contract Progress Schedule shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2.

Once the Baseline Contract Progress Schedule has been accepted by the Engineer, with or without comments, it will represent the as-planned schedule for the Work. It shall then be known as the Baseline Schedule and shall be the Contract Progress Schedule of Record until such time as the schedule is updated or revised under Subsections 8.02.E.4 and .5.

Failure to submit a Baseline Contract Progress Schedule within seventy-five (75) Calendar Days after Notice to Proceed could result in withholding of full or partial payments by the Engineer. Beyond one-hundred and fifteen (115) Calendar Days after Notice to Proceed, no pay estimate will be approved by the Engineer until the Baseline Contract Progress Schedule has been submitted, unless otherwise agreed to by the Engineer.

4. Revised Contract Progress Schedules

Upon review and acceptance by the Engineer of revised activities and/or logic ties contained in Time Entitlement Analyses prepared in accordance with Subsection 8.02.E.8 or Recovery Schedules prepared in accordance with Subsection 8.02.E.9, these changes shall be incorporated into the next Stated Contract Progress Schedule as a Revised Contract Progress Schedule. A Revised Contract Progress Schedule shall be due with the pay estimate immediately following the Engineer's acceptance of the schedule changes.

Revised Contract Progress Schedules shall include a comprehensive listing of all activities added to or deleted from the Contract Progress Schedule of Record as well as a complete listing of all logic and activity relationship changes which have been made. All changes shall be clearly highlighted and identified and explained and justified in writing as part of the Contract Progress Schedule Narrative required in Subsection 8.02.E.2.a.

Revised Contract Progress Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2.

Once a Revised Contract Progress Schedule has been returned by the Engineer to the Contractor as "Resubmittal Not Required", it shall become the Revised Contract Progress Schedule of Record, meaning it shall be used for subsequent Stated Contract Progress Schedules.

Except as otherwise designated by a Contract Modification, no Revised Contract Progress Schedule that extends performance beyond the Contract Time and/or any Contract Milestone shall qualify as a Revised Contract Progress Schedule of Record.

5. Stated Contract Progress Schedules

Stated (Updated) Contract Progress Schedules shall be submitted by the Contractor along with the first pay estimate of each month.

A Stated Contract Progress Schedule shall consist of the following:

ITEM 100. (Continued)

1. A Schedule Narrative consistent with Subsection 8.02.E.2.a.
2. A Summary Contract Progress Schedule consistent with Subsection 8.02.E.7.

Each Stated Contract Progress Schedule shall reflect updated progress to the status date and shall forecast the finish dates for in progress activities and remaining activities, but shall not change any activity descriptions, durations, or sequences without the acceptance of the Engineer. Updated progress shall be limited to as built sequencing and as built dates for completed and in progress activities. As built data shall include actual start dates, remaining Work Days, and actual finish dates for each activity.

Stated Contract Progress Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2 along with the first pay estimate of the month, but no later than fourteen (14) Calendar Days after the pay estimate submittal.

Accepted Stated Contract Progress Schedules shall update and replace the Contract Progress Schedule of Record.

Stated Contract Progress Schedules submitted later than fourteen (14) Calendar Days after the pay estimate submittal will be deemed to be no longer useful and will not qualify for payment. However, failure to submit a Stated Contract Progress Schedule within any monthly period, whether on time or late, could result in the withholding by the Engineer of the remainder of the pay estimate payment due for that time period.

6. Short Term Construction Schedule

The Contractor shall provide a Short Term Construction Schedule that details the daily work activities, including multiple shift work that the Contractor intends to conduct, in a bar chart format. The daily activities shall correspond to the Contract Progress Schedule activities, but shall be at a greater level of detail.

The Short- Term Construction Schedule shall be submitted at each Weekly or Bi-Weekly (every two (2) weeks) Contract Progress Meeting, but, regardless of the frequency of progress meetings, shall be submitted no less often than once every two (2) weeks. It shall display all work for a thirty-five (35) Calendar Day period: completed work for the two (2) week period prior and all planned work for the three (3) week period following the Contract Progress Meeting or the end of the previous two (2) week period.

The Contractor shall be prepared to discuss the Short Term Construction Schedule, in detail, with the Engineer in order to coordinate field inspection staff requirements, schedule of work affecting abutters, and corresponding work with affected utilities.

Short Term Construction Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and 8.02.E.2.

Failure to submit Short Term Construction Schedules at each Contract Progress Meeting could result in withholding of full or partial pay estimate payments by the Engineer.

ITEM 100. (Continued)**7. Summary Contract Progress Schedule**

The Summary Contract Progress Schedule is not a separate, stand-alone schedule that must be formally submitted by the Contractor, unless requested by the Engineer, but is a schedule that is created using the internal coding of the detailed Contract Progress Schedule. The Contract Progress Schedule shall be coded such that a summary-level Contract schedule may be produced that identifies major physical classes, structures, facilities or other elements of the Work as discussed in Subsection 8.02.E.1. The durations of summary activities shall coincide with the Contract Time and Contract Milestones shown in Subsection 8.03 - Prosecution of Work. The activity descriptions for all summary-level activities shall be subject to the review and acceptance of the Engineer.

8. Time Entitlement Analysis

A Time Entitlement Analysis (TEA) consists of a descriptive narrative, prepared in accordance with Subsection 8.02.E.2.a, and an as-built CPM schedule, in the form of a fragnet, see Subsection 8.02.B - Definition of Terms, that has been developed from the project's Contract Progress Schedule of Record, see Subsections 8.02.E.3-5, and illustrates the impact that additional time, added to the Contract Progress Schedule of Record by a delay or an extra work order, has on the Contract Progress Schedule of Record's critical path, Contract Milestones, and/or Contract Completion Date. TEAs shall be used to determine the schedule impact of extra work orders. A TEA may also be referred to as a Proposal Schedule, a Time Impact Analysis or a Time Impact Evaluation.

TEAs shall incorporate all proposed activities and logic ties required to implement the extra work order or other schedule impacts as well as detailing all impacts on existing activities, logic ties, the critical path, Contract Milestones, and the Contract Completion Date. In addition, TEAs shall accurately reflect any changes made to activities, logic ties, and restraints, necessitated by the extra work order, for the completion of the remaining work.

Any TEA prepared for the purpose of requesting a time extension shall clearly indicate any proposed overtime hours or additional shifts that are proposed to be incorporated in the schedule. The Engineer shall have final discretion over the use of overtime hours and additional shifts and shall have the right to require that overtime hours and/or additional shifts be used to minimize the duration of time extensions if it is determined to be in best interest of the Department to do so.

TEAs shall be prepared and submitted in accordance with the requirements of Subsections 8.02.E.1 and 2 and shall be based on the Contract Progress Schedule of Record for the time the delay starts.

TEAs shall be submitted as part of an extra work order submission, a request for a time extension or within fourteen (14) Calendar Days after a request for a TEA by the Engineer.

When accepted, the changes included in a TEA shall be incorporated into a Revised Contract Progress Schedule per the requirements of Subsection 8.02.E.4 and resubmitted to the Engineer.

ITEM 100. (Continued)

Failure to submit a TEA within fourteen (14) Calendar Days of a request from the Engineer could result in withholding of full or partial pay estimate payments by the Engineer.

9. Recovery Schedules

The Contractor shall promptly report to the Engineer all schedule delays during the prosecution of the Work.

In addition, a Recovery Schedule shall be required whenever the Critical Path of the Contract Progress Schedule of Record exceeds the greater of:

- a.) A delay of twenty (20) Calendar Days, or
- b.) A delay equal to 5% of the Calendar Days remaining until the Contract Completion Date

due to any of the three situations listed below:

- 1. If the contractor is behind schedule due to the fault of the contractor.
- 2. If the contractor anticipates becoming behind schedule due to the fault of the contractor.
- 3. When the delay is not the fault of the Contractor and the Department chooses to recover the lost time and requests a proposal to achieve that.

Recovery Schedules shall be prepared and submitted in accordance with Subsections 8.02.E.1 and .2 within fourteen (14) Calendar Days of any of the cases listed above.

Failure to submit a Recovery Schedule when and as required could result in withholding of full or partial pay estimate payments by the Engineer.

10. Disputes

All schedules shall be submitted, reviewed, dispositioned, and accepted in the timely manner specified in Subsection 8.02.C so as to provide the greatest possible benefit to the execution of this Contract.

Any dispute concerning the acceptance of a schedule or any other question of fact arising under this subsection shall be determined by the Engineer.

Pending resolution of any dispute, the last schedule accepted by the Engineer will remain as the Contract Schedule of Record as described in Subsections 8.02.E.3-5.

F. Basis of Payment

- 1. All required schedule-related work, including, but not limited to, computer software, schedule preparation and schedule submittals will be paid under Pay Item 100.01 as defined below.
- 2. Failure to submit schedules within the time periods stated elsewhere in this subsection could result in the withholding of full or partial Contract pay estimate payments by the Engineer.

ITEM 100. (Continued)

3. A fixed price of \$200,000 will be provided to the Contractor for the Project Schedule Submittal requirements contained herein. The Contractor is advised that this “fixed price” value is separated from what the Department considers to be the Contractor’s general condition costs for payment purposes only. If the Contractor deems it necessary to include additional costs to provide all of the requirements of this section, these additional costs shall be included in the Contractor’s general conditions. The fixed price payment item shall be earned as a fixed amount set by the Department at the time of the bid. Each bidder shall include this fixed price bid item value in the total bid value. Failure to do so will be grounds for the rejection of the bid.

4. Twenty percent (20%) of this pay item will be paid upon receipt by the Engineer of the Contractor’s Baseline Schedule, prepared and submitted in accordance with Subsection 8.02.E.3.

5. The remaining eighty percent (80%) of this pay item will be paid in equal monthly installments distributed across the time remaining until the time that the payment occurring immediately after Substantial Completion has been made. This calculation will be subject to revision should Substantial Completion be delayed beyond the original calculation date.

PAY ITEM

100.01	SCHEDULE OF OPERATIONS - FIXED PRICE \$200000	LUMP SUM
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<u>ITEM 100.91</u>	<u>PRE AND POST CONST. SURVEY, INSTRUMENTATION AND MONITORING (S-1)</u>	<u>LUMP SUM</u>
<u>ITEM 100.92</u>	<u>PRE AND POST CONST. SURVEY, INSTRUMENTATION AND MONITORING (S-2)</u>	<u>LUMP SUM</u>

The work of these Items shall consist of the following:

1. Conducting pre-construction surveys to document the existing condition of the adjacent building at 63 Washington Avenue (Site 1) and the Saint Rose Church at 598 Broadway (Site 2),
2. Furnishing, installing, monitoring, and removing settlement monitoring points, crack monitoring gages, and vibration monitoring seismograph, as indicated by Engineer
3. Surveying to monitor building elevation and settlement before, during and after construction,
4. Monitoring vibrations of building before, during and after construction,
5. Monitoring crack gages before, during and after construction,
6. Reporting the survey, crack gage and vibration monitoring data,
7. Developing and implementing response action plans in the event the settlement and/or vibration criteria are exceeded,
8. Conducting a post-construction survey to document the condition of the 63 Washington Avenue building after completion of construction, and
9. Restoring the building surface after removal of settlement points and crack gages

The settlement criteria for the buildings at 63 Washington Avenue and 598 Broadway are as follows:

Threshold Value:	0.5 inches
Limiting Value:	0.75 inches

The vibration criteria for the buildings at 63 Washington Avenue and 598 Broadway are as follows:

Threshold Value:	0.5 inch per second peak particle velocity
Limiting Value:	1.0 inch per second peak particle velocity

MATERIALS

Surveying Unit and Survey Monitoring Points

The optical level or total station unit used for building settlement monitoring shall provide an accuracy of 0.005 foot (1/16 inch) or better. Readings shall be repeatable within 0.005 feet (1/16 inch).

Settlement monitoring points shall be reflective prisms suitable for use with the total station unit or optical scales graduated in units of 0.005 feet (1/16 inch).

Seismograph

The seismograph shall have the following minimum features:

ITEMS 100.91 & 100.92 (Continued)

- Seismic range: 0.01 to 4 inches per second with an accuracy of +/- 5 percent of the measured peak particle velocity or better at frequencies between 10 Hertz and 100 Hertz, and with a resolution of 0.01 inches per second or less.
- Three channels for vibration monitoring.
- Two power sources: internal rechargeable battery and charger and 115 volts AC. Battery must be capable of supplying power to monitor vibrations continuously for up to 24 hours.
- Instruments must be capable of producing strip chart recordings and readings on site within one hour of obtaining readings. Provide computer software to perform analysis and produce reports of continuous monitoring.
- Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of one minute or less.
- Certification shall be provided to indicate that the seismograph is calibrated and maintained in accordance with the equipment manufacturer's calibration requirements and that, where applicable, calibrations are traceable to the National Institute of Standards and Technology.

Crack Monitoring Gages

The crack monitoring gages shall be plexiglass, flat surface epoxy mount gages, graduated in 1 millimeter units and capable of measuring up to 20 millimeter of movement in two orthogonal directions, as manufactured by Avongard Products USA Ltd., Humboldt Manufacturing Company, or RST Instruments Ltd., or equal.

CONSTRUCTION METHODS**Pre-Construction Building Survey**

The Contractor shall retain and pay an experienced Professional Engineer registered in the Commonwealth of Massachusetts to perform a pre-construction survey of the 63 Washington Avenue building and a pre-construction survey of the 598 Broadway Church building to document the existing conditions of the buildings prior to start of construction activities. The surveys, as a minimum, shall locate, measure, photograph and otherwise document any visible cracks, defects, distortion, settlement, and other signs of distress both inside and on the outside of the buildings. The product shall be an original written report stamped and signed by the Engineer performing the survey and four (4) copies, including photographs, DVD's, plans, sketches and attachments, which shall be submitted to the Engineer a minimum of five (5) days prior to commencement of any construction activity. Copies of the report shall be distributed to the MassDOT Resident Engineer and the building owners.

Building Settlement Surveying

The Contractor shall establish a minimum of five (5) settlement points each on the exterior north wall and on the exterior west wall of the 63 Washington Avenue building, and on the exterior north and east walls of the 598 Broadway building. Survey points shall be located at approximately 5, 15, 25, 40 and 60 feet of the northwest corner of the 63 Washington Avenue building, on both faces, and the northeast corner of the 598 Broadway building, on both faces.

ITEMS 100.91 & 100.92 (Continued)

The survey points shall be attached using masonry anchors or other methods that provide a secure and stable attachment.

Building settlement surveys shall be referenced to the project benchmark to be provided by the Department and maintained by the Contractor in accordance with Standard Specification Section 5.07.

The Contractor shall perform a minimum of three (3) initial surveys of the building settlement points prior to start of any construction activities within 50 feet of the building. During periods when any construction activities are occurring within 50 feet of the buildings and when the excavation for the south abutment (and Wall Structure No. 1 adjacent to the Saint Rose Church) is open, building settlement surveys shall be taken by the Contractor at least once per week as long as the total measured settlement is less than the threshold value. If the measured settlement exceeds the threshold value, the frequency of building settlement survey shall be a minimum of twice per week. Settlement surveys shall continue at a frequency of once per week for one month after backfilling of the south abutment and removal of the excavation support system is complete, and thereafter on once every two weeks basis until the construction of the bridge superstructure is complete.

Building survey measurements shall be submitted to the Engineer within 24 hours after the survey is taken. The survey report shall highlight any survey point and data that exceed the threshold value.

If any settlement point measurement exceeds the threshold value, the Contractor shall immediately evaluate the cause of the settlement. Based on the evaluation, the Contractor shall submit to the Engineer within five (5) days a proposed plan of action to modify the construction procedures so that the settlement will not exceed the limiting value during the completion of construction.

If any settlement point measurement exceeds the limiting value, the Contractor shall immediately stop work in the vicinity of the building and further evaluate the cause of the settlement. Based on the evaluation, the Contractor shall submit to the Engineer within five (5) days a proposed plan of action to modify the construction procedures so that any additional settlement will be prevented or minimized during the completion of construction.

Vibration Monitoring

The seismograph shall be located on the sidewalk on the west side of the building, on the north side of the main entrance to the building. The seismograph may be located within the contractor's fenced work area, but shall be at least 5 feet from the top of the excavation support system in Washington Avenue.

The Contractor shall operate the seismograph for a minimum of five (5) consecutive 24-hour periods prior to the start of construction to establish baseline levels. Copies of the report summarizing the recorded baseline levels shall be distributed as outlined previously a minimum of five (5) days prior to commencement of any construction activity.

ITEMS 100.91 & 100.92 (Continued)

Following the start of construction the Contractor shall monitor the vibration levels on a continuous basis during the following activities: installation of excavation support system in Washington Avenue, driving of sheet piles for the center pier, demolition of the existing bridge structure including the south abutment and wing wall, structural excavation, placement and compaction of backfill and roadway base course, and other activities as required by the Engineer. The seismograph shall be set to trigger recording at a peak particle velocities of 0.2 inches per second or less.

The Contractor shall maintain records of the measured vibration levels, including date, time, measured vibration level. The Contractor shall review and evaluate the vibration monitoring data on a daily basis, and shall notify the Engineer within 24-hours of any measurement that exceeds the threshold value. The Contractor shall submit a report of the measured vibration levels every two weeks or as requested by the Engineer.

During all monitoring of vibration-producing construction activities the Contractor shall document all events that are responsible for the measured vibration levels, and submit the documentation to the Engineer with the data.

If vibration measurements exceed the threshold value, the Contractor shall take the following actions:

1. Verify the measurement reading and proper operation of the seismograph,
2. Ensure work is being performed in accordance with the Contract Documents,
3. Notify the Engineer within 24 hours, and
4. Hold a meeting within 48 hours with representatives of the Contractor, the Engineer and MassDOT.

If vibration measurements exceed the limiting value, the Contractor shall take the following actions:

1. Stop vibration-producing construction operations,
2. Verify the measurement reading and proper operation of the seismograph,
3. Ensure work is being performed in accordance with the Contract Documents,
4. Notify the Engineer within 4 hours of becoming aware of the measurement exceeding the limiting value,
5. Hold a meeting with representatives of the Contractor, Engineer and MassDOT within 24 hours, and
6. Develop plan of action to reduce construction vibrations to below the threshold level before resuming vibration-producing construction activities.

Crack Monitoring Gages

Crack monitoring gages shall be installed at up to 8 existing cracks on the exterior face of the northwest portion of the building, or on the interior walls or floor, at locations to be determined by the Engineer in the field, at the time of the pre-construction survey, and prior to the start of construction. Crack monitoring gages shall also be installed on up to 6 new cracks that develop during construction, at locations determined in the field by the Engineer.

ITEMS 100.91 & 100.92 (Continued)

The crack monitoring gages shall be installed in a horizontal or vertical direction, as appropriate, to directly measure horizontal and vertical movement across the crack. The gages shall be installed in accordance with the manufacturer's instructions, and shall be maintained for the duration of construction. Damaged or malfunctioning crack gages shall be replaced at no additional cost as required by the Engineer.

Crack gage readings shall be taken at the same time as the building settlement surveys, and the crack gage data submitted at the same time as the settlement survey data. Crack gage measurements shall be reported to the nearest 0.5 millimeter (0.02 inch), based on visual reading of the gage. For crack gages on the basement floor, vertical offset across the crack shall also be measured and reported to the nearest 0.5 millimeter (0.02 inch). Upon termination of the settlement surveys and crack gage readings, the crack gages shall be removed and the surface restored.

Post-Construction Building Survey

The Contractor shall retain and pay an experienced Professional Engineer registered in the Commonwealth of Massachusetts to perform a post-construction survey of the 63 Washington Avenue building to document the condition of the building prior at the completion of construction activities. The purpose of the post-construction survey is to document any changes in building condition that may have occurred during the construction period. This survey, as a minimum, shall locate, measure, photograph and otherwise document any visible cracks, defects, distortion, settlement, and other signs of distress both inside and on the outside of the building, including the post-construction condition of items noted during the pre-construction survey. The product shall be an original written report stamped and signed by the Engineer performing the survey and four (4) copies, including photographs, DVD's, plans, sketches and attachments, which shall be submitted to the Engineer no later than two weeks after pavement and finishes are installed on the new bridge. Copies of the report shall be distributed to the MHD Resident Engineer and the building owner.

BASIS OF PAYMENT

The work to be done under these Items shall be paid at the Contract LUMP SUM Price under Item Nos. 100.91 and 100.92. The lump sum price may be submitted for payment on the following schedule:

30% upon completion of the pre-construction survey, installation of settlement points, submittal of required equipment documentation, initial survey and monitoring, and acceptance by the Engineer.

50% remaining in equal monthly amounts based on the anticipated schedule of monitoring in accordance with the Contractor's approved schedule.

20% remaining upon satisfactory completion of the post-construction survey and Engineer's acceptance of the final report.

ITEM 100.93**PRE AND POST CONST. SURVEY,
INSTRUMENTATION AND MONITORING (S-3)****LUMP SUM**

The work of this Item shall consist of the following:

1. Conducting pre-construction surveys to document the existing condition of other structures and buildings adjacent to the work site where deep excavations are occurring and as directed by the Engineer.
2. The buildings include, but are not limited to, structures at 125, 127 & 129 Willow Street.
3. Perform preconstruction photos and/or videos to document existing conditions of the adjacent structures.
4. Prepare post construction photos and/or videos of the adjacent structures.

Prior to proceeding with the construction of Retaining Walls, the contractor shall perform pre construction surveys of adjacent houses.

The preconstruction surveys on existing structures shall consist of photographs and/or videos to document existing conditions of the adjacent structures prior to performing any deep excavations. The photographs and video surveys will document existing cracks and other visible signs of distress including exterior of building walls and foundation walls.

A complete report of the existing conditions shall be made, and if requested, one copy will be delivered to the owner. If at any time thereafter a claim for damages or alleged damages is filed by the owner or tenant, the contractor shall conduct further detailed examinations.

BASIS OF PAYMENT

The work to be done under this Item shall be paid at the Contract Lump Sum Price under Item No. 100.93. The LUMP SUM price shall be submitted for payment on the following schedule:

30% upon completion of the pre-construction surveys, documentation, and acceptance by the Engineer.

70% remaining upon satisfactory completion of the post-construction survey and Engineer's acceptance of the final report.

ITEM 100.99**MBTA TRACK DEFORMATION MONITORING****LUMP SUM**

The work under this Item includes furnishing all supervision, labor, materials, equipment, layout and services required to install, maintain, and monitor deformation monitoring points (DMPs) as specified herein.

The purpose of the proposed monitoring is to protect the railroad tracks owned by Massachusetts Bay Transportation Authority (MBTA) during installation, excavation, construction and backfill of adjacent braced steel sheeting required for construction of proposed pier. The monitoring procedures specified below are intended to confirm that the braced steel sheeting is performing in a satisfactory manner and to identify locations of excessive ground movement so that it can be controlled and corrected in a timely manner. Any corrective actions required by the Contractor will be at no additional cost to the Department or MBTA.

The Contractor shall monitor the vertical and horizontal/lateral movements of railroad track rails by installing survey deformation monitoring points (DMPs) consisting of a permanently affixed assembly. Alternatively, DMPs may consist of reflective electro-optical distance measuring (EDM) targets that are affixed to the rails with appropriate adhesive. DMPs shall be installed at no more than sixteen (16) foot spacing on the track rails and extend fifty (50) feet along the tracks beyond the limits of the braced steel sheeting at each end. Contractor shall coordinate responsibilities for installation and monitoring of DMPs on tracks with MBTA Track Engineers.

Procedure

1. Installation of monitoring points shall be coordinated with the MBTA. Survey of the monitoring points on the MBTA tracks shall be performed by the Contractor and signed off by MBTA Track Engineers.
2. Contractor shall submit the locations and identification numbers of all monitoring points prior to the start of the Work.
3. Contractor shall submit the records of measurements to the Engineer and MBTA within twenty-four (24) hours of measurement in tabular format allowing comparison of current data to previous data, including baseline, and showing a complete history of movement versus time.
4. Monitor DMPs every two days during installation of the braced steel sheeting, or more frequently if movements are approaching the specified Response Values. The frequency of the readings may be adjusted (more or less frequent) in agreement with the MBTA and Engineer based on interpretation of the data and the type of activity occurring at the site. Additional monitoring points and increases in the survey frequency shall be considered incidental to the costs associated with this Item.

ITEM 100.99 (Continued)

5. A minimum of two (2) sets of independent baseline readings of each DMP shall be taken and submitted to the Engineer prior to beginning installation of the braced steel sheeting. Survey both vertical and horizontal positions. Survey data shall be reported to an accuracy of 0.01 feet.
6. In cases where track maintenance activities are performed to correct movements, new baseline measurements shall be established and its relationship to the previous baseline documented.
7. Survey instruments used for vertical deformation monitoring shall have a minimum accuracy of ± 0.10 inches (standard deviation for one mile of double run leveling) and a minimum setting accuracy of ± 1.0 arc seconds. Leveling staffs shall be non-telescopic in design (i.e., 'Chicago' style leveling staff). A bull's eye bubble shall be used to plumb the leveling rod.
8. Survey instruments used for horizontal deformation monitoring shall have a minimum accuracy of ± 3.0 arc seconds and a minimum display reading less than or equal to the accuracy. Distances less than 30 feet shall be measured with a standardized steel tape used in conjunction with a tension handle. Distances greater than 30 feet shall be measured with an Electro-Optical Distance Measuring Instrument (EDM). Distances between 30 and 100 feet shall be verified with a standardized steel tape in conjunction with a tension handle. Electronic pointing shall be used to minimize error due to possible misalignment of the EDM axis and telescope. Centering shall be accomplished using high precision optical plummets or mechanical centering devices.
9. EDM equipment used for horizontal deformation monitoring shall, after calibration, have a minimum accuracy of ± 0.20 inches plus 5 parts per million
10. Interpretation of data and implementation of plans of action:
 1. The Engineer shall interpret data from all survey deformation monitoring points (DMPs) described herein as well as any additional data the Contractor elects to collect.
 2. Table 1 indicates Response Values for selected instruments. The actions associated with these Response Values are defined below. Plans for such actions are referred to herein as plans of action, and actual actions to be implemented are referred to herein as response actions. Response Values are subject to adjustment by the Engineer as indicated by prevailing conditions or circumstances.

TABLE 1. RESPONSE VALUES

Instrument	Response Value
DMPs on MBTA Track Rails	1/4-inch

ITEM 100.99 (Continued)

3. If the Response Values are met or exceeded, the Contractor shall stop work immediately and notify the Engineer and MBTA. Contractor shall meet with the Engineer and MBTA and agree upon what response action shall be taken. Contractor shall then implement remedial action(s) within 24 hours to mitigate deformations, as directed by the Engineer. Remedial work/response actions shall be at no additional cost to the Department or MBTA. MBTA may elect to do the remedial track work with their own forces, in which case the Contractor shall reimburse the Department for that work.
4. The criteria presented herein are intended only to establish a guideline and in no way relieves the Contractor of his/her responsibility for preventing detrimental movements or damage causing distress to the train track rails or adjacent structures. Contractor shall provide all measures necessary to control movements to within established performance criteria, or to lesser amounts as required to prevent damage. The Engineer may require the Contractor to take steps to control movements to levels which are lower, at no additional cost to the Owner, if in the opinion of the Geotechnical or Structural Engineer, the measured or observed movements are detrimental or damaging.
5. All work shall be executed in a manner as to prevent damage to existing tracks, structures and to any other public or private property. Damage to existing facilities shall be repaired by the Contractor at his/her own expense.
6. Contractor shall monitor and interpret data from additional instrumentation that he/she deems necessary to insure the safety of his work. The Geotechnical Engineer, Structural Engineer, MassDOT and MBTA are not responsible for safety of the work based on the instrumentation data.
11. Remove monitoring points at the completion and acceptance of all work adjacent to the MBTA tracks.

BASIS OF PAYMENT

The work to be done under this Item shall be paid at the Contract Lump Sum Price under Item 100.99. The lump sum price shall be submitted for payment on the following schedule:

30% upon installation of monitoring points, submittal of required equipment documentation, baseline survey and monitoring, and acceptance by the Engineer.

50% in equal monthly amounts based on the anticipated schedule of monitoring in accordance with the Contractor's approved schedule.

20% remaining upon satisfactory completion and Engineer's acceptance of the work.

<u>ITEM 102.3</u>	<u>CONTROL OF INVASIVE PLANTS EXISTING ON SITE</u>	<u>HOUR</u>
<u>DESCRIPTION</u>		

This item consists of controlling invasive plants within the project limits and documenting the extent of existing invasive plants within the project limits for the purposes of preventing spread during construction. An Invasive Plant Management Strategy (IPMS) for their control shall be submitted to the Engineer for review and approval and the IPMS shall be implemented on site.

Payment is per hour on site and shall be compensation for a minimum crew of 2 licensed applicators, 2 back-pack sprayers and mist-blowers, a properly equipped spray truck with spray hoses, and a tank with sufficient capacity for a full day of work

The overall intent is to improve the habitat value of the site, protect proposed landscape restoration, improve future maintenance operations, and attempt to prevent future spread both on-site and to adjacent sites.

Measures to prevent the introduction of invasive plant species to the site and to correct their introduction as a result of construction-related activities shall be covered under the Standard Specifications, Division I - Sections 7.01(D) Plant Pest Control and 7.13 Protection and Restoration of Property as amended in these Special Provisions.

The definition of invasive plant species shall be as described by Massachusetts Invasive Plant Advisory Group (MIPAG): “non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.”

Control of invasive plants shall begin immediately with the initiation of construction and continue for a minimum of two (2) growing seasons. Work shall be done during the growing season from May – October.

The general expectation of treatment results is that there is no re-growth of targeted plant species at end of the first season unless otherwise addressed in the Invasive Plant Management Strategy.

Areas identified for vegetation control measures shall be as determined in the field by the Engineer and a MassDOT Landscape Architect.

SUBMITTALS

No work shall begin without approval of the submittals. Within 15 business days prior to the site walk, the Contractor shall submit all qualifications to the Engineer.

Contractor shall submit company qualifications to MassDOT Landscape Design for review and approval. Submittals shall include the following items:

ITEM 102.3 (Continued)**Qualifications****Invasive Plant Control Contractor Qualification:**

1. Company must provide proof of qualifications by providing the following:
 - a. Narrative describing company, its expertise and experience with invasive plant control.
 - b. Demonstrate experience with herbicide treatment as part of restorations and in sensitive areas
 - c. Describe company's technical qualifications and past performance.
2. Company must meet licensing requirements:
 - a. All crew applicators must have a Massachusetts Commercial Applicator License (CORE).
 - b. At least one or more applicator must have ROW certification if required for specific project.
 - c. Company must provide name(s) of applicator(s) and Applicator License/Certification number for all contractor crew leaders working on the project.
 - d. Company must provide documentation of any warnings, penalties or fines received in the last three (3) years.
3. Company must provide proof of experience with invasive plant control and include following:
 - a. At least five (5) references from prior invasive plant control work completed in last five (5) years. Provide contact information including address, phone number and email.
 - b. Provide a summary of each of these projects including nature of the problem, specific invasive vegetation treated, dates and period of treatment, methodologies used, and summary of success or not in terms of meeting performance objectives. Include summary of equipment used.
 - c. Photo documentation of these projects.
 - d. GPS coordinates of project locations, if available.
4. Crew leader must have expertise with invasive plant control and provide the following:
 - a. Have held Core license for at least five (5) years.
 - b. Resume listing five (5) or more years of experience applying pesticides with the company or five (5) years of previous experience with another company specializing in vegetation management.

The following companies are pre-approved by MassDOT Landscape Design Section.

Groundscapes Express, Inc.

P.O. Box 737

Wrentham, MA 02093

Contact: John Engwer

Phone: 508-384-7140, Fax: 508-384-0571

Native Habitat Restoration

P.O. Box 334

Stockbridge, MA 01262

Contact: Jess M. Toro : 413-358-7400

Sari Hoy: 413-394-0277

ITEM 102.3 (Continued)**New England Environmental, Inc.**

15 Research Drive
Amherst, MA 01002
Contact: Scott Fisher
Phone: 413-256-0202, FAX: 413-256-1092

Vegetation Control Service, Inc.,

2342 Main Street
Athol, MA 01331
Contact: Jeff Taylor
Phone: 800-323-7706

Polatin Ecological Services, LLC

Old Blake Farm
334 Mountain Road
Gill, MA 01351
Contact: Chris Polatin
Phone: 413-367-5292, Fax 732-474-9757

New England Wild Flower Society

180 Hemenway Road
Framingham, MA 01701
Contact: Ted Elliman
508-877-7630 x 3203

Invasive Plant Management Strategy (IPMS):

Prior to the start of any invasive plant control treatment, submit in writing an IPMS proposal and Schedule of Control for approval by the Engineer and MassDOT Landscape Architect at least thirty (30) days prior to proposed treatment. All chemicals and methods proposed shall be consistent with applicable Massachusetts Wetlands Protection Act - Orders of Conditions. The IPMS shall include, but not be limited to, the following:

1. Description of treatment areas including identification of targeted invasive plant species, locations, approximate size of areas and digital photos with time/date stamp. Delineate treatment areas with polygons outlining their perimeter or locations of individual plants. A free-hand sketch drawn on construction plans or an aerial photo can be used to show locations.
2. Proposed methods of treatment for each species or area; such as manual removal, cutting, or herbicide treatment.
3. If herbicides are proposed, submit product label including application methods and rates for each (entire MSDS information need not be submitted if available online).
4. Proposed application rate.
5. Proposed time of treatment based on target plant species and construction schedule.
6. Method for disposing of invasive plant material including stems, trunks, branches, roots, associated soils, etc.
7. General monitoring schedule.
8. Preliminary re-treatment schedule. Re-treatment shall be based on assessment of initial results and time of year.
9. Proposed performance metrics, or measure of treatment success, which shall be agreed upon by MassDOT.

Note: The IPMS is critical for identifying pre-construction conditions as well as strategies for minimizing import or spread of invasive plants. Failure to provide approved IPMS may jeopardize this item, in which case, the contractor will be responsible for control of invasive plants found on site at no cost to the contract.

ITEM 102.3 (Continued)**Follow-up Treatment Schedule:**

Depending on treatment results after the first year, the IPMS may be re-assessed for the second year to address additional concerns or adjust to conditions. A follow-up treatment schedule shall follow the same format as outlined above and submitted to the Engineer and MassDOT Landscape Architect for approval at least thirty (30) days prior to proposed treatment.

Reporting:

Within two (2) weeks after each application, the Contractor shall provide to the Engineer a completed and signed MassDOT Herbicide Use Report. . Where applicable, the Contractor shall provide the name/s of the associated water body/bodies affected by potential discharge, per the requirements of Sections 7.1 and 7.2 of the USEPA Pesticide General Permit for the Discharges from the Application of Pesticides.

Photo Documentation:

Digital photos with date and time stamp shall be provided with IPMS and follow-up reporting.

MATERIALS

All proposed herbicides shall be as approved prior to use in the IPMS. Herbicides shall be labeled for the method of treatment and shall meet all federal, state and local regulation requirements. All herbicide used shall be MDAR approved materials for Sensitive Areas. Application rates will depend on herbicide proposed and shall be per the manufacturer's label for specific application.

CONSTRUCTION METHODS

All methods used shall be as approved in the IPMS.

Prior to the start of any work, Contractor shall walk the site with the Engineer and the MassDOT Landscape Architect. The purpose of the site inspection is to identify limits of work, mark locations of areas designated for treatment and mark individual plants targeted for treatment or removal according to the IPMS. Contractor shall be responsible for marking plants and delineating areas to be preserved, removed, and otherwise treated. Fencing or other materials needed for marking and for delineating protected areas shall be incidental to this item.

Herbicide Applications

All herbicide application shall conform to Massachusetts Pesticide Laws and Regulations per the Massachusetts Department of Agricultural Resources (MDAR) Pesticide Bureau.

ITEM 102.3 (Continued)

Mixing, applying and/or disposing of herbicides shall always be in accordance with instructions on their labels and all applicable federal, state, and local regulations. Mixing shall not occur within sensitive areas, wetlands, or buffer zones.

Contractor shall not spray 2 hours prior to precipitation and during rain. The Contractor shall be responsible for monitoring weather conditions and adjusting the work schedule as appropriate for the herbicide and application method to be used.

Targeted vegetation shall be identified and marked prior to treatment. Plants treated by foliar spray, injection or glove application or other methods that leave standing vegetation, as opposed to cut-stump application, shall remain clearly marked for identification through the contract period.

Desirable vegetation shall be protected from both spray and other physical damage.

Contractor is responsible for any damage to vegetation not designated for removal or treatment.

Vegetation damaged shall be restored. Cost of replacement plants and/or restoration shall be borne by the Contractor.

Contractor shall ensure that the public does not enter a work area while herbicide application or spraying is underway.

Disposal of Invasive Plant Material

All material to be cleared shall become the property of the Contractor. The satisfactory disposal of all cleared plant material (seeds, roots, woody vegetation, associated soils, etc.) shall be the Contractor's responsibility.

The Contractor shall take measures to prevent viable plant material from leading to further infestations (seeds, roots, woody material, etc.) while stockpiled, in transit, or at final disposal locations. All precautions shall be taken to avoid contamination of natural landscapes with invasive plants or invasive plant material.

Chipping, shredding, or on-site burning of plant material shall not be permitted unless written approval is given as part of the Invasive Plant Management Strategy.

Contractor shall be responsible for treating areas of re-growth due to improper disposal.

In some instances, it may be preferable to dispose of plants on site with on-going monitoring for re-sprouting. This may be used only if method and disposal locations have been approved in the IPMS. Site work such as grading and seeding to stabilize disposal area shall be incidental to this item.

ITEM 102.3 (Continued)**MONITORING**

After initial herbicide treatment, all treated plants and areas shall be monitored through visual observation and re-treated as necessary and appropriate throughout the season and for the duration of the contract per the management proposal and schedule for control submitted by Contract. Monitoring shall be incidental to all items.

A brief Monitoring Report on treatment results that includes digital photographs shall be submitted to the Engineer and MassDOT Landscape Architect at the end of each season.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.3, CONTROL OF INVASIVE PLANTS EXISTING ON SITE will be measured for payment by the HOUR of crew time spent on the project doing actual work. A crew shall be defined as a minimum of two licensed applicators each equipped with (at minimum) back-pack sprayer and mist blower. The crew shall also have a properly equipped spray truck with hoses and a tank with sufficient capacity for a full day of work.

Payment will be based upon time spent on the project doing actual work and shall not include travel time to and from the Contractor's place of business and it shall also not include time for investigative field trips.

Item 102.3, CONTROL OF INVASIVE PLANTS EXISTING ON SITE will be paid for at the contract unit price per HOUR; which price shall include all labor, materials, equipment, tools and any incidentals required to complete the work as specified.

ITEM 102.51**INDIVIDUAL TREE PROTECTION****EACH**

The work under this item shall conform to the relevant provisions of Sections 101, 644 and 771 and the following:

The purpose of this item is to prevent damage to branches, stems and root systems of existing individual trees as well as shrubs and other quality vegetation to remain, and to ensure their survival. To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain. Where these activities will occur within 10 feet (3 meters) of the canopy of trees or where directed, the Contractor shall take the appropriate protective measures specified herein.

This item shall be used when construction activities are likely to occur within the canopy of individual trees or where there may be any risk of damage to trees.

The Contractor shall be solely responsible for judging the full extent of the work requirements, including, but not necessarily limited to any equipment and materials necessary for providing tree protection.

Incidental to the cost of this item, the Contractor shall retain the services of a certified arborist, who shall make recommendations as to the specific appropriate treatment of trees within or near the work zone.

Prior to any construction activities, the Contractor and Arborist shall walk the site with the Engineer and Town Tree Warden to identify which trees will require protection and to determine approved measures. The Arborist shall make recommendations as to appropriate methods to protect trees. The Engineer will have final decision as to trees and methods.

The Contractor is responsible for the protection of all existing trees and plants within and immediately adjacent to the construction area that are not designated to be removed for the length of the construction period.

SUBMITTALS

Incidental to this item, the Contractor shall provide to the Engineer one (1) copy American National Standards Institute (ANSI) Standard Z-133.1 and A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance, Part 1: Pruning. These references shall be kept by the Engineer at his office for the length of the Contract.

Prior to start of work, the Contractor shall submit to the Engineer the name and certification number of the Massachusetts Certified Arborist referenced herein. Cost for Certified Arborist for all activities pertaining to this Item shall be incidental to this item.

ITEM 102.51 (Continued)**MATERIALS**

Fencing for individual plants shall be polyethylene fencing or chain link fence (new or used).

Staking for individual tree protection fencing shall be steel posts or 2x4 lumber as directed and approved by the Engineer.

Wood chips shall conform to provisions of Wood Chip Mulch under Materials Section M6.04.3.

Trunk protection shall be 2x4 cladding, at least 8 feet (2.4 meters) in length, clad together with wire. Alternative materials shall be at the approval of the Engineer. Alternative materials shall provide adequate protection from anticipated construction activities and shall not injure or scar trunk. Trunk protection shall include burlap to separate trunk cladding from bark.

Incidental to this item, the Contractor shall provide water for maintaining plants in the construction area that will have exposed root systems for any period during construction.

CONSTRUCTION METHODS

To the extent possible, to avoid soil compaction within the root zone, construction activities including, but not limited to, vehicle movement, excavation, embankment, staging and storage of materials or equipment shall not occur underneath the canopy (drip line) of trees to remain. Where these activities will occur within 10 feet (3 meters) of the canopy of trees, the Contractor shall provide Individual Tree Protection as specified herein.

For individual tree protection, the Contractor shall set posts and fencing at the limits of the tree canopy. Where construction activities closer to the trees is unavoidable, the contractor shall tie branches out of the way and place wood chips to a depth of 6 inches (150 mm) on the ground to protect the root systems. The Contractor shall wrap the area of the trunk of the tree with burlap prior to armoring with 2x4 cladding. Cladding for tree trunks shall extend from the base of the tree to at least 8 feet (2.4 meters) from the base.

Where excavation within canopy is unavoidable, the Contractor shall use equipment and methods that shall minimize damage to the tree roots, per recommendations of the Certified Arborist. Such methods may require root pruning prior to, as well as during, any excavation activities.

All fencing, trunk protection, branch protection, and woodchips shall be maintained throughout the duration of the contract. Protective fencing shall be repaired and woodchip mulch replaced as necessary during the duration of the contract at no additional cost.

ITEM 102.51 (Continued)**Cutting and Pruning**

Some pruning of roots and branches may be a necessary part of construction. Pruning will be performed on the same side of the tree that roots have been severed.

The Contractor shall retain the services of a Massachusetts State Certified Arborist to perform any cutting of limbs, stem or roots of existing trees. All cuts shall be clean and executed with an approved tool. Under no circumstances shall excavation in the tree protection area be made with mechanical equipment that might damage the existing root systems.

Any tree root area exposed by construction shall be covered and watered immediately. Exposed tree roots shall be protected by dampened burlap at all times until they can be covered with soil.

Watering

Water each tree within the construction area where work is in progress twice per week until the surrounding soil of each tree is saturated for the duration of construction activities.

Removal of Protection

After all other construction activities are complete, but prior to final seeding, wood chips, fencing, branch protection, and trunk protection materials shall be removed and disposed off site by the Contractor at no additional cost.

Tree Damage

The Contractor shall be held responsible for the health and survival of the existing trees in the immediate vicinity of the of the construction area. Damage that, in the Engineer's opinion, can be remedied by corrective measures shall be repaired immediately. Broken limbs shall be pruned according to industry standards. Wounds shall not be painted. Trees or shrubs that are damaged irreparably shall, at the Engineer's discretion, be replaced per the requirements of Division I of these Special Provisions. Cost of replacement trees shall be borne by the Contractor.

COMPENSATION

Where the plans show specific, individual trees to remain and where grading or other disturbance is shown within the drip line of these trees or where the Engineer determines that an individual tree must be protected, these trees shall be protected and paid for under Item 102.51 Individual Tree Protection per each tree protected.

Payment under this item shall be scheduled throughout the length of contract: 30 percent of value shall be paid upon installation, 30 percent approximately halfway through the contract, and the remainder to be paid at the end of the contract after completion of construction operations that would disturb plants and after the protection materials have been removed and properly disposed of off-site by the Contractor.

ITEM 102.51 (Continued)

Compensation for Individual Tree Protection will be paid for at the contract unit price per EACH under ITEM 102.51. This item shall include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work, including the services of a certified arborist, water and fertilizer, and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

Cost of wood chips, as required, shall be incidental to this item.

ITEM 114.1**DEMOLITION OF SUPERSTRUCTURE OF
BRIDGE NO. C-09-001****LUMP SUM**

The work under this Item shall conform to the relevant provisions of Sections 112 and 960 of the Standard Specifications, Section 961 of the Supplemental Specifications dated June 15, 2012 and the following:

This work shall include the complete demolition, removal and disposal of the existing bridge superstructure, Bridge No. C-09-001 (3FL). This includes, but is not limited to, the following:

- Removal of fence
- Removal of concrete deck, sidewalk and curbs
- Removal of steel beams
- Removal of bearings and anchor bolts

Work under this item shall also include the removal and disposal of all treated existing wood product, if any, as directed by the Engineer. The proper handling and disposal of all existing treated wood products shall be paid for under Item 184.1.

Not included under this Item is the partial removal and disposal of the existing substructure, which shall be included under Item 115.6 Stone Masonry Substructure Demolition and Item 127.1 Reinforced Concrete Excavation.

All Contractors or Subcontractors performing lead based paint removal, containment and collection, surface preparation, or coating of structural steel must be pre-qualified by MassDOT in the Painting (Structural) category.

The contractor shall be responsible for providing temporary protective shielding system to prevent any debris from falling onto the MBTA Railroad as a result of the operation. The cost of providing installation and removal of the temporary protective shielding shall be paid for under Item 994.01.

The Department makes no assurances regarding the presented conditions, dimensions, and materials of the existing structure as shown on the Contract Drawings. The Contractor shall verify all existing conditions and construction features of the bridge to be demolished, as necessary, for the proper planning and completion of the work. The Contractor shall base his/her bid on his/her own findings without any additional compensation for variances from the Plans or these Special Provisions regarding actual conditions for the items to be removed.

ITEM 114.1 (Continued)

The Contractor shall prepare and submit a plan indicating his/her proposed demolition procedures and methods to be used, including equipment, tools, devices, crane capacity and location, schedule of operations, etc. to the Engineer for approval. The requirements for equipment and all procedures utilized shall be in conformance with the intent of Subsection 960. of the Supplemental Specifications dated June 15, 2012. The demolition procedure and any necessary calculations and drawings shall be stamped by a Professional Structural Engineer registered in the Commonwealth of Massachusetts. Work under this Item may not commence until the Engineer has given written approval of the method of demolition.

The Contractor shall take all measures necessary to prevent any debris resulting from demolition or equipment from falling onto the railroad tracks or adjacent right-of-way. Debris from construction must be carefully contained within the work zones and prevented from falling onto the tracks. No foreign material or debris resulting from the Contractor's operations shall be permitted to enter or remain on the tracks or adjacent right-of-way below. The Contractor shall be required to remove any debris generated from construction from the site immediately and to restore portions of the site affected by the operation to their original undisturbed condition or better. Removal of debris generated by demolition and construction will be performed at the Contractor's own expense. Contractor shall be responsible for dust control as a result of the demolition operations.

All materials removed under this Item shall become the property of the Contractor and shall be properly disposed of in accordance with the Standard Specifications and these Special Provisions. All existing members shall be suitably braced and supported throughout the demolition process. Care shall be taken so as not to damage any portion of the existing substructure to remain; or any adjacent structures to remain. Any damage to the existing substructure or adjacent structures to remain shall be repaired as directed by the Engineer at the Contractor's expense. During the prosecution of work, the Engineer may reject any method or use of equipment that is deemed unsuitable.

Plans of the existing structure may be reviewed at the Massachusetts Department of Transportation – Highway Division, 10 Park Plaza, Boston, Massachusetts, Bridge Section, Room 6430.

GENERAL REQUIREMENTS FOR DEMOLITION AND WORK INVOLVING PAINTED STEEL

(9/20/2012)

Demolition work involving painted steel shall conform to the requirements of Section 961 of the Supplemental specifications dated June 15, 2012.

Work Involving Painted Steel

Hazardous materials shall be removed in the immediate area of any intended welding, heating, saw cutting or burning of steel. Hazardous material removal is required to allow the demolition of structural steel, railings, drainage systems, utility supports, steel lamp posts, etc.

ITEM 114.1 (Continued)

The contractor shall assume that the coatings on the steel contain lead (Pb), unless otherwise determined by testing. The contractor shall certify in writing to the Engineer the results of all testing, and shall also certify that any lead (Pb) coated steel removed from the project was not reused or buried, but was sent to a scrap metal recycling facility.

Implement and maintain programs and procedures, which comply with the requirements of this specification and all applicable standards and regulations. Comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the regulation of this specification, follow the more restrictive requirements.

This requirement is intended only for the demolition and preparation prior to repair and does not include provisions for recoating of steel.

Environmental

All applicable portions of Sections 961.65 “Worker Protection” and 961.66 “Environmental Protection and Monitoring” shall be followed when performing this work.

During chemical stripping a hand washing facility may be used in lieu of a decontamination/changing facility.

Hazardous material shall be collected during the disassembly and disposed of as outlined in Section 961.68 “Handling of Hazardous Waste and Reporting Release Programs”.

The applicable submittals shall be according to Section 961.69 “Submittals”.

Cleaning/Removal**Cutting Or Burning Of Steel**

All surfaces to be welded, heated, saw cut or burned shall be cleaned so as to remove all contaminants and/or hazardous materials, which could be discharged to the environment as a function of the subsequent operations.

Lead paint shall be removed in its entirety in an area prescribed by a 6 inch (15 cm) minimum offset from the required work. The paint removal operation may be dry abrasive blasting, wet abrasive blasting or chemical stripping.

Proper level of containment shall be used when performing this work in accordance with Section 961.67 “Containment”. Full containment is not required during chemical stripping operation however; the Contractor shall install proper shielding and/or tarpaulins under the chemical stripping operations in order to catch all debris generated during this procedure. A cleaned area must be inspected and approved before the demolition operations are started.

ITEM 114.1 (Continued)

During cleaning operations the Contractor shall be required to furnish and erect temporary floodlights illuminating the steel surface at a minimum of 30-foot candles. This lighting shall be used in areas where there is insufficient lighting for proper cleaning operations and inspection. The Contractor shall supply electrical power.

The Contractor shall provide support for interim and final inspection of the bridge during cleaning operations. This support shall include the necessary traffic controls and safe access to the work.

Mechanical Disassembly Of Steel

All surfaces to be mechanically disassembled by shear cutting or removing bolts or rivets shall not require de-leading. When shear cutting or removing bolts or rivets, the Contractor shall not use any method that will cause dust and/or particles to be emitted and/or dispersed into the environment to an extent that would expose the workers above the Action Levels of $30\mu\text{g}/\text{m}^3$.

For purposes of limiting the lead (Pb) dust, the Contractor will be required to dampen the lead paint work areas.

The contractor shall install a proper shielding and/or tarpaulins under all lead-paint-coated surfaces to be shear cut or bolts or rivets ordered removed in order to catch any loose lead paint chips, dust or particles.

BASIS OF PAYMENT

Payment for the work described under this ITEM will be paid for at the Contract LUMP SUM Price for ITEM 114.1, DEMOLITION OF SUPERSTRUCTURE OF BRIDGE NO. C-09-001; which price shall include full compensation for all labor, tools, equipment, materials, testing, loading, transportation, disposal, approvals, and permits necessary for the completion of the work including any costs associated with hazardous materials.

The contractor will make his own investigation of the structure to be demolished including the materials that are part of, or may be stored in the structure. No increase will be made to the bid price due to the nature of the materials involved in the demolition. All costs for permits, dump fees, special handling of hazardous materials, etcetera, shall be included in the bid price of the demolition item.

ITEM 115.6
ITEM 127.1**STONE MASONRY SUBSTRUCTURE DEMOLITION**
REINFORCED CONCRETE EXCAVATION**CUBIC YARD**
CUBIC YARD

The work under these Items shall conform to the relevant provisions of Section 112 of the Standard Specifications and shall include the demolition and disposal of the stone masonry and reinforced concrete substructure elements, respectively, as shown on the Plans or as directed by the Engineer.

The Contractor shall take all precautions necessary so as not to damage those portions of the structure that are to remain. Any portions of the existing structure that are to remain which become damaged as a result of the Contractor's operations, as determined by the Engineer, shall be repaired to the satisfaction of the Engineer at no additional cost to The Department. Additionally, the Contractor shall be responsible for maintaining portions of the existing substructures throughout demolition and construction. All concrete and stone masonry removed under this Item shall become the property of the Contractor and shall be satisfactorily disposed of by him away from the work site.

Any removal beyond the designated limits, or damage to those portions of the structures designated to remain which ensue due to the Contractor's operations, shall be repaired or replaced to the satisfaction of the Engineer at the sole expense of the Contractor.

The Contractor shall take all measures necessary to prevent any debris resulting from demolition or equipment from falling onto the railroad tracks or adjacent properties. Debris from construction must be carefully contained within the work zones and prevented from falling onto the tracks. Any material or equipment that accidentally falls onto the adjacent properties shall be removed immediately at the Contractor's expense. Any damage to adjacent properties resulting from Contractor's operations shall be repaired as directed by the Engineer at the Contractor's expense. Contractor shall be responsible for dust control as a result of the demolition operations.

BASIS OF PAYMENT

The quantity of reinforced concrete excavation to be paid for under this item excludes the reinforced concrete that is included for payment under Item 115.1 Demolition of Bridge No. C-09-001. The limits of bridge demolition are shown on the Plans.

Payment for the work to be done under these Items shall be at the Contract Unit Price per CUBIC YARD of stone masonry or concrete substructure removed; which price shall include full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work in a manner satisfactory to the Engineer, including saw-cutting and/or jack hammering of concrete.

Existing stone masonry removal shall be paid for under ITEM 115.6 STONE MASONRY SUBSTRUCTURE DEMOLITION and existing reinforced concrete removal shall be paid for under ITEM 127.1 REINFORCED CONCRETE EXCAVATION.

ITEM 120.**EARTH EXCAVATION****CUBIC YARD**

Work under this item shall conform to the relevant provisions of Sections 112, 120 and 140 of the Standard Specifications, and the following:

GENERAL

The work shall consist of excavation, disposal or compaction of all materials not being removed under some other item which is encountered within the limits of the contract in accordance with the specifications and in close conformity with the lines, grades, thicknesses and cross sections shown on the plans or established by the Engineer. The work under this item shall also the proper removal and disposal of underground utilities encountered including abandoned gas lines.

CONSTRUCTION METHODS

Any abandoned gas lines encountered may contain pcb's and shall be tested and properly disposed in accordance with all applicable codes and regulations.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and Payment for work under this item shall be at the Contract Unit Price per CUBIC YARD; which shall constitute full compensation for all labor, tools, equipment, testing, removal and proper disposal of material necessary to complete the work to the satisfaction of the Engineer.

ITEM 129.3**OLD PAVEMENT EXCAVATION****CUBIC YARD**

Work under this item shall conform to the relevant provisions of Sections 112, 120 and 140 of the Standard Specifications, and the following:

The work under this item shall include the removal and proper disposal of existing pavements within the limits of work, which may include remnants of old concrete pavements in addition to asphalt pavements.

CONSTRUCTION METHODS

The Contractor shall perform all excavations in such a manner as to maintain the safety of traffic operating in the vicinity including maintaining access to adjacent properties at all times.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 129.3, OLD PAVEMENT EXCAVATION shall be measured and paid for at the Contract Unit Price per CUBIC YARD; which shall constitute full compensation for all labor, tools, equipment, shielding and proper disposal of material necessary to complete the work to the satisfaction of the Engineer.

ITEM 153. CONTROLLED DENSITY FILL – EXCAVATABLE CUBIC YARD

Work under this Item shall conform to the 2012 Supplemental Specifications to the Standard Specifications for Highways and Bridges section M4.08.0, Controlled Density Fill (CDF), the Plans, and the following:

The work to be done under this item shall include the back filling around proposed drainage structures drain pipe trenches, and/or other utility trenches to be used when conventional methods of backfill are unsuitable, and/or as directed by the Engineer. Controlled density fill shall not be used to backfill utility excavations or trenches in areas of full depth pavement construction.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 153., CONTROLLED DENSITY FILL – EXCAVATABLE shall be measured and paid for at the Contract unit price per CUBIC YARD; which price shall be full compensation for, including, but not limited to, all labor, equipment, worker protection, environmental compliance, materials, tools, and any incidentals required to complete the work to the satisfaction of the Engineer in accordance with all requirements of the contract.

ITEM 153.2 LIGHTWEIGHT AGGREGATE FILL CUBIC YARD

Work under this item shall consist of the furnishing, placing and compacting lightweight expanded shale aggregate fill as backfill behind structures. This work shall be performed as hereinafter specified, to the dimensions indicated on the plans, or as directed by the Engineer. Excavation required prior to placement of lightweight aggregate fill shall be included under ITEM 120. EARTH EXCAVATION or ITEM 140. BRIDGE EXCAVATION, as appropriate.

MATERIALS**Lightweight Aggregate Fill**

Lightweight aggregate for geotechnical fill shall be rotary kiln expanded shale lightweight aggregate or approved equal meeting requirements of ASTM C 330. No by-product slags, cinders or by-products of coal combustion shall be permitted. Grading shall conform to ASTM C 330 as specified below. Lightweight aggregate shall have proven record of durability as determined by ASTM C 88 and ASTM C 131, and be non-corrosive, as determined by CAL DOT 422. The Lightweight aggregate shall have the following properties:

ITEM 153.2 (Continued)

Gradation as Delivered	
Sieve	ASTM C 330 Requirement (percent passing sieve)
1-inch	100
3/4 in	90-100
3/8 in	10-50
No. 4	0-15

Physical Properties			
Property		Test Method	Requirement
Density	Minimum	ASTM D 4254	40 lb/ft ³ or greater
	Maximum ¹	ASTM D 4253	65 lb/ft ³ or less
Soundness (MgSO ₄ - 5 cycles)		ASTM C 88	Max.10% loss
Abrasive Resistance		ASTM C 131	Max. 40% loss
In-situ Phi (φ) Angle		ASTM D 3080	36° or greater

Electrochemical Properties		
Property	AASHTO Test Method	Requirement
Resistivity	T 288 I	>3000 ohm-cm
pH	T 289 I	5-10
Chloride Content	T 291 I	<100 mg/kg
Sulfate Content	T 290 I	<200 mg/kg

¹ Saturated-surface-dry particles.

SUBMITTALS

Prior to the start of construction, submit product data sheet, laboratory test results, and certification from the Manufacturer that the lightweight fill product supplied meets the requirements of this Section.

CONSTRUCTION METHODS

Construct the lightweight fill in accordance with the following, unless otherwise approved by the lightweight fill manufacturer:

ITEM 153.2 (Continued)**General**

In all fill areas, compact the foundation subgrade with at least 10 passes of a smooth wheel vibratory compactor weighing at least 10,000 lbs. In confined areas, proof compact with a vibratory plate compactor weighing at least 200 lbs. and imparting an impact load of at least 2.5 tons. Where exposed footing subgrades are at or near the groundwater level, static proof compaction methods may be recommended by the geotechnical engineer in lieu of vibratory methods. Remove unsuitable soils and soils that do not become firm under proof compaction and replace with compacted Gravel Borrow to create a competent bearing surface.

- A. When applicable, except as noted below, lightweight fill placement shall conform to the requirements of Sections 120, 140 and 150 of the MassDOT Standard Specifications.
- B. Place lightweight aggregate in areas free from standing water or frozen ground. Compact lightweight aggregate in place during construction using a smooth drum roller between 8 and 12 tons (static weight), sized to compact adequately without causing significant particle breakage. Place and compact the aggregate in maximum 12-inch loose lifts with a minimum of 2, maximum of 4 orthogonal passes of compaction equipment, unless otherwise directed by the Engineer. Perform additional passes of compaction, if required, until all measurable compaction has been achieved. Do not over-compact the lightweight aggregate. Construction equipment, other than for compaction shall not operate on the exposed fill.
- C. The top surface of the lightweight aggregate fill lying directly below the gravel base course shall be chinked by additional rolling of the lightweight fill to prevent infiltration of fines.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for furnishing, placing and compacting lightweight expanded shale aggregate as backfill for the abutments to the minimum limits shown on the drawings shall be at the Contract unit price per CUBIC YARD for the actual volume of fill placed and accepted. Payment shall be full compensation for all labor, materials and equipment required to complete the work.

ITEM 180.1**HEALTH AND SAFETY PLAN****LUMP SUM**

It is the Contractor's ultimate responsibility to ensure the health and safety of all the Contractor's employees and subcontracting personnel, the Engineer and his/her representatives, and the public from any on-site chemical contamination.

A Health & Safety Plan (HASP) shall be prepared by a Certified Industrial Hygienist or other experienced individual with the appropriate training required by OSHA to prepare such a plan, and it shall include the components required by OSHA 29 CFR 1910.120(b). The preparer's name and work experience shall be included as part of the Health and Safety Plan submittal. The HASP must be stamped by a Certified Industrial Hygienist certifying that it complies with all applicable laws, regulations, standards and guidelines, and that it provides a degree of protection and training appropriate for implementation on the project during the execution of this contract.

The HASP shall be designed to identify, evaluate, and control health and safety hazards associated with the work on this project and provide for emergency response if needed. The HASP shall be a dynamic document with provision for change to reflect new information, new practices or procedures, changing site environmental conditions or other situations which may affect site workers and the public. Health and safety procedures provided by the Contractor shall comply with all the appropriate regulations that address employee working conditions (e.g. OSHA, RCRA, CERCLA). In addition, guidelines of NIOSH, OSHA, USCG, EPA, etc., shall be followed. Equipment used for the purpose of health and safety shall be approved and meet pertinent standards and specifications of the appropriate regulatory agencies.

A copy of the Health and Safety Plan shall be maintained on-site at all times by the Contractor. The on-site copy shall contain the signature of the Engineer and each on-site employee of the Department, Contractor and subcontractors. The employee's signature on the Health and Safety Plan shall be deemed prima facie evidence that the employee has read and understands the plan. A copy of the plan with signatures shall be submitted to the Engineer at the conclusion of the Contract, or at the Engineer's request. Signature sheets shall be submitted monthly, or at the request of the Engineer.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work to be done under this Item shall be paid at the Contract LUMP SUM Price under Item 180.1 for the development and preparation of the HASP by a qualified individual.

ITEM 180.2 **IMPLEMENTATION OF HEALTH AND SAFETY PLAN** **HOUR**

For all construction activities which require handling or exposure to potentially hazardous materials, the Health and Safety Plan shall specify an on-site Safety Officer. The Site Health and Safety Officer duties shall include, but are not limited to: implementation of the site Health and Safety Plan, training, evaluating risks, safety oversight, determining levels of personnel protection required, and performing any required monitoring at the site. A Daily Log shall be kept by the on-site Safety Officer and provided weekly to the Engineer. This log shall be used to record a description of the weather conditions, levels of personnel protection being employed, monitoring data and any other information relevant to on-site safety conditions. The Site Health and Safety officer shall sign and date the Daily Log.

In the event that subsurface contamination is discovered during construction, the Site Safety Officer shall be present to oversee all handling, storage, sampling, and transport of such contaminated materials.

The level of protection, relative to respiratory and dermal hazards, required to ensure the health and safety of on-site personnel will be stipulated in the Health and Safety Plan and will be subject to modification by the on-site Safety Officer based on changing site and weather conditions and the following factors: type of operation or activity, chemical compounds identified on-site, concentration of the chemicals, physical state of the hazardous materials, potential duration of exposure to hazardous materials, dexterity required to perform work, decontamination procedures, necessary personnel and equipment, and type of equipment to be utilized.

The Contractor shall be required to provide appropriate personnel protective equipment for anyone who is working in an area either containing or suspected of containing a hazardous environment. This work will include both individuals physically working in these areas and those directing the work of same. Contingencies for upgrading the level of protection for on-site workers will be identified in the Health and Safety Plan and the contractor shall have the necessary materials/equipment on hand to implement the level of protection upgrade in a timely manner. Payment for this level of upgraded protection shall be paid for under Item 180.3.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Implementation of the Health and Safety Plan will be paid at the contract price per HOUR of implementing the plan and shall include the cost of enforcement by an on-site Safety Officer. Personnel protective clothing and equipment below Level "C" shall be considered incidental to the project and shall be a cost borne by the Contractor.

ITEM 180.3**PERSONNEL PROTECTION LEVEL 'C' UPGRADE****HOUR****GENERAL**

The Contractor shall provide to all workers disposable, protective clothing appropriate to the hazard level of the work. The protective equipment and its use shall be in strict compliance with the Health and Safety Plan (Item 180.1), and all appropriate regulations that address employee working conditions.

BASIS OF PAYMENT

Payment for this item will be at the contract unit price, per HOUR, per man, required in level 'C' personnel protection.

ITEM 180.4**MONITORING/HANDLING AND STOCKPILING
OF CONTAMINATED SOILS****CUBIC YARD**

The On-Site Safety Officer or Environmental Consultant shall be responsible for evaluating soil with non-natural discoloration, petroleum or chemical odor, the presence of petroleum liquid or sheening on the groundwater surface or any abnormal gas or materials in the ground which are known or suspected to be contaminated with oil or hazardous materials. Soil suspected of gasoline contamination shall be field tested using the jar headspace procedures according to Department of Environmental Protection Bureau of Waste Site Cleanup Interim Policy #WSC-94-400 (Remedial Waste Management Policy for Petroleum Contaminated Soil) and the Bureau of Waste Prevention Policy #COMM-97-001 (Reuse and Disposal of Contaminated Soil and Massachusetts Landfills). The Engineer shall be contacted immediately when any results indicate contamination requiring soil removal or when contamination not detectable by on-site instrumentation is suspected.

The Contractor shall be required to supply all personnel and materials necessary to comply with this section and to support the anticipated levels of protection and monitoring described above.

Within limited areas of the project site, it is likely that excavated soils may be contaminated. Where possible, all soils originally in contact with groundwater will be replaced in the same trench up to the existing groundwater level. All soils determined to be contaminated by metals or petroleum products, through the monitoring/evaluation program will be stockpiled for disposal in accordance with all Massachusetts Department of Environmental Protection statutes, policies, and regulations.

The Environmental Consultant/Contractor shall be responsible for identifying a disposal/recycling facility and obtaining all permits, approvals, Bill of Lading, etc. prior to the removal of the contaminated soil from the site. Any soils contaminated with hazardous materials that are not of petroleum origin shall be handled on a case-by-case basis. The contractor shall obtain at least three bids for the handling and disposal of any contaminated material. All manifest, bills of lading, etc. will be the responsibility of the Contractor with copies provided to the Department. The Contractor is also responsible for hiring a Licensed Site Professional (LSP), as needed, for oversight and Bills of Lading, etc.

ITEM 180.4 (Continued)**METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

Measurement shall be made by the volume, per CUBIC YARD, of contaminated material monitored, handled and/or stockpiled as described under Item 180.4.

Work under this Item shall be paid at the Contract bid price, per CUBIC YARD, which payment shall be considered compensation for all labor, tools, equipment and materials needed to do the work as described above.

ITEM 180.5**LICENSED SITE PROFESSIONAL****HOURLY**

A Licensed Site Professional (LSP) will be required to provide the services necessary to comply with the requirements of the Massachusetts Contingency Plan (MCP), 310 CMR 40.000, with respect to the scope of work for this Contract. These services will include, but are not limited to, sampling and analysis of potentially contaminated media, preparation of IRA, URAM and RAM Plans, status reports, transmittal forms, release notification forms, completion statements and related documents required pursuant to the MCP. The LSP will be responsible for obtaining all permits related to the characterization, treatment, and disposal of contaminated media. The LSP will provide oversight of handling, stockpiling, re-use, treatment and disposal of contaminated media, including preparation of Bills of Lading, Manifests, and related shipping documents. Environmental technicians, including but not limited to personnel conducting field monitoring and sampling, data interpretation and support services directly related to MCP compliance, are also included in this Item.

The name and qualifications of the Licensed Site Professional will be submitted to the Engineer for review and approval at least two weeks prior to initial site activities. The LSP shall have significant experience in the oversight of MCP activities at active construction sites.

The LSP will coordinate all activities with MassDOT and the Massachusetts Department of Environmental Protection through the Engineer or his/her designee.

The LSP will be responsible for adequately characterizing contaminated media to insure that it meets the requirements of the MCP and, in the case of contaminated media to be disposed of off-site, to insure that it meets the acceptance criteria set forth by the disposal facility. The LSP will be responsible for adequately characterizing subsurface conditions prior to backfill in areas where contaminated soil/sediments are excavated. The cost of laboratory analyses conducted in accordance with the sampling and assessment requirements for compliance with the MCP will be paid for within the unit bid price for Item 180.4 – Monitoring/ Handling and Stockpiling of Contaminated Soils, Item 180.6 – Soil Tests, and Item 181.11 Disposal Of Unregulated Soil, Item 181.12 Disposal Of Regulated Soil - In-State Facility, Item 181.13 Disposal Of Regulated Soil Out-Of-State Facility and Item 181.14 Disposal Of Hazardous Waste.

BASIS OF PAYMENT

Work under this Item shall be paid at the Contract price per HOUR of service provided to perform the work as described above. The bid price shall reflect the cost of the LSP and any environmental technicians providing the services described above.

ITEM 180.6**MISCELLANEOUS SOIL TESTING****EACH**

The work under this item shall conform to all relevant provisions of the Standard Specifications, the Special Provisions and the following:

The Engineer may, from time to time, direct the Contractor to obtain soil samples from various locations within the project area and to perform laboratory analyses on those soil samples to assess reuse or disposal options.

SAMPLING AND ANALYSIS

The Contractor shall collect discrete soil sample(s) from locations within individual soil piles or specific land area identified by the Engineer. The soil samples shall be collected at a depth specified by the Engineer. The samples shall be delivered to a Massachusetts certified laboratory using proper chain-of-custody documentation for the analysis of Resource Conservation and Recovery Act (RCRA) 8 metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, poly-aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH). Subsequent testing, depending upon initial results, may be required for Toxicity Characteristic Leaching Procedure (TCLP) analyses (Method 1311) for metals.

DATA EVALUATION AND REPORT

The Contractor shall review and summarize the laboratory data from the soil sampling analyses. The data will be compared to Massachusetts Contingency Plan (MCP) soil standards and acceptance criteria for soil recycling and landfill disposal facilities. A letter report shall be delivered to the Engineer outlining the soil sampling methods, laboratory analyses results and proposed options for reuse or disposal of the soil.

METHOD OF MEASUREMENT

Miscellaneous Soil Testing will be measured by EACH round of samples collected, tested and reported to the Engineer. A round of samples shall include a total of three samples.

BASIS OF PAYMENT

Miscellaneous Soil Testing will be paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment and incidental costs required to complete the work specified above.

<u>ITEM 181.11</u>	<u>DISPOSAL OF UNREGULATED SOIL</u>	<u>TON</u>
<u>ITEM 181.12</u>	<u>DISPOSAL OF REGULATED SOIL - IN-STATE FACILITY</u>	<u>TON</u>
<u>ITEM 181.13</u>	<u>DISPOSAL OF REGULATED SOIL OUT-OF-STATE FACILITY</u>	<u>TON</u>
<u>ITEM 181.14</u>	<u>DISPOSAL OF HAZARDOUS WASTE</u>	<u>TON</u>

GENERAL:

The work under these Items shall include the transportation and disposal of contaminated material excavated, or excavated and stockpiled. It shall also include the cost of any additional laboratory analyses required by a particular disposal facility beyond the standard disposal test set.

Excavation of existing subsurface materials may include the excavation of contaminated soils. The Contractor shall be responsible for the proper coordination of characterization, transport and disposal, recycling or reuse of contaminated soils. Disposal, recycling or reuse will be referred to as “disposal” for the remainder of this specification unless otherwise stated. However, regardless of the use of the term herein, there will be no compensation under these items for reuse within the project limits. The Contractor will be responsible for coordinating the activities necessary for characterization, transport and disposal of contaminated soils. Such coordination will include the Engineer and his/her designee overseeing management of contaminated materials. Contaminated soils must be disposed of in a manner appropriate for the soil classification as described below and in accordance with the applicable laws of local, state and federal authorities. The Contractor shall be responsible for identifying a disposal facility(s) licensed to accept the class of contaminated soils to be managed and assure that the facility can accept the anticipated volume of soil contemplated by the project. The Contractor shall be responsible for hiring a Licensed Site Professional (LSP) and all ancillary professional services including laboratories as needed for this work. The Contractor will be responsible for obtaining all permits, approvals, manifests, waste profiles, Bills of Lading, etc. subject to the approval of the Engineer prior to the removal of the contaminated soil from the site. The Contractor and LSP shall prepare and submit to the Engineer for approval all documents required under the Massachusetts Contingency Plan (MCP) and related laws and environmental regulations to conduct characterization, transport, and disposal of contaminated materials.

CLASSES OF CONTAMINATED SOILS:

The Contractor and its LSP shall determine, in accordance with Items 180.1 through 180.6, if soil excavated or soil to be excavated is unregulated soil or contaminated soil as defined in this section. Such materials shall be given a designation for purposes of reuse or disposal based on the criteria of the Massachusetts Contingency Plan (MCP). Soils and sediments which are not suitable for reuse will be given a designation for purposes of off-site disposal based on the characterization data and disposal facility license requirements. The Classes of Contaminated Soils are defined as follows:

ITEMS 181.11 thru 181.14 (Continued)

Unregulated Soil consists of soil, fill and dredged material with measured levels of oil and hazardous material (OHM) contamination at concentrations below the applicable Reportable Concentrations (RCs) presented in the MCP. Unregulated soil consists of material which may be reused (or otherwise disposed) as fill within the Commonwealth of Massachusetts subject to the non-degradation criteria of the MCP (310 CMR 40.0032(3), in a restricted manner, such that they are sent to a location with equal or higher concentrations of similar contaminants. Disposal areas include licensed disposal facilities, approved industrial settings in areas which will be capped or covered with pavement or loamed and seeded, and for purposes of this project should be reused as fill within the project site construction corridor whenever possible. The material cannot be placed in residential and/or environmentally sensitive (e.g. wetlands) areas. Under no circumstances shall contaminated soils be placed in an uncontaminated or less contaminated area (including the area above the groundwater table if this area shows no sign of contamination).

The Contractor shall submit to MassDOT the proposed disposal area for unregulated soils for approval. If such a disposal area is not a licensed disposal facility, the Contractor shall submit to the Engineer analytical data to characterize the disposal area sufficiently to verify that the unregulated material generated within the MassDOT construction project limits is equal to or less than the contaminant levels at the disposal site and meets the non-degradation requirements of the MCP. In addition, the Contractor shall provide written confirmation from the owner of the proposed disposal area that s/he has been provided with the analytical data for both the materials to be disposed as well as the disposal site characterization and that s/he agrees to accept this material. **A Material Shipping Record or Bill of Lading, as appropriate, shall be used to track the off-site disposal of unregulated soil and a copy, signed by the disposal facility or property owner, shall be provided to the Engineer in order to document legal disposal of the unregulated material.**

The cost of on-site disposal of unregulated soil within the project area will be considered incidental to the item of work to which it pertains.

Regulated Soil consists of materials containing measurable levels of OHM that are equal to or exceed the applicable Reportable Concentrations for the site as defined by the MCP, 310 CMR 40.0000. Regulated soil which meets the MCP reuse criteria of the applicable soil/groundwater category for this project area may be reused on site provided that it meets the appropriate geotechnical criteria established by the Engineer. Regulated Soil may be reused (as daily or intermediate cover or pre-cap contouring material) or disposed (as buried waste) at lined landfills within the Commonwealth of Massachusetts or at an unlined landfill that is approved by the Massachusetts Department of Environmental Protection (DEP) for accepting such material, in accordance with DEP Policy #COMM-97-001, or at a similar out-of-state facility. It should be noted that soils which exceed the levels and criteria for disposal at in-state landfills, as outlined in COMM-97-001, may be shipped to an in-state landfill, but require approval from the DEP Division of Solid Waste Management and receiving facility. An additional management alternative for this material is recycling into asphalt. Regulated Soils may also be recycled at a DEP approved recycling facility possessing a Class A recycling permit subject to acceptance by the facility and compliance with DEP Policy #BWSC-94-400. **Regulated Soil removed from the site for disposal or treatment must be removed via an LSP approved Bill of Lading, Manifest or applicable material tracking form.** This type of facility shall be approved/permitted by the State in which it operates to accept the class of contaminated soil in accordance with all applicable local, state and federal regulations.

ITEMS 181.11 thru 181.14 (Continued)

Hazardous Waste consists of materials which must be disposed of at a facility permitted and operated in full compliance with Federal Regulation 40 CFR 260-265, Massachusetts Regulation 310 CMR 30.000, Toxic Substances Control Act (TSCA) regulations, or the equivalent regulations of other states, and all other applicable local, state, and federal regulations. All excavated materials classified as hazardous waste shall be disposed of at an out-of-state permitted facility. This facility shall be a RCRA hazardous waste or TSCA facility, or RCRA hazardous waste incinerator. This type of facility shall be approved/permitted by the State in which it operates to accept hazardous waste in accordance with all applicable local, state and federal regulations and shall be permitted to accept all contamination which may be present in the soil excavate. The Contractor shall ensure that, when needed, the facility can accept TSCA waste materials i.e. polychlorinated biphenyls (PCBs). **Hazardous waste must be removed from the site for disposal or treatment via an LSP approved Manifest.**

MONITORING/SAMPLING/TESTING REQUIREMENTS:

The Contractor shall be responsible for monitoring, sampling and testing during and following excavation of contaminated soils to determine the specific class of contaminated material. Monitoring, sampling and testing frequency and techniques should be performed in accordance with Items 180.1 through 180.6. Additional sampling and analysis may be necessary to meet the requirements of the disposal facility license. The cost of such additional sampling and analysis shall be included in the bid cost for the applicable disposal items. The Contractor shall obtain sufficient information to demonstrate that the contaminated soil meets the disposal criteria set by the receiving facility that will accept the material.

No excavated material will be permanently placed on-site or removed for off-site disposal until the results of chemical analyses have been received and the materials have been properly classified. The Contractor shall submit to the Engineer results of field and laboratory chemical analyses tests within seven days after their completion, accompanied by the classification of the material determined by the Contractor, and the intended disposition of the material. The Contractor shall submit to the Engineer for review all plans and documents relevant to LSP services, including but not limited to, all documents that must be submitted to the DEP.

Copies of the fully executed Weight Slips/Bills of Lading/Manifests/Material Shipping Records or other material tracking form received by the Contractor from each disposal facility and for each load disposed of at that facility, shall be submitted to Engineer and the Contractor's LSP within three (3) days of receipt by the Contractor. The Contractor is responsible for preparing and submitting such documents for review and signature by the LSP or other appropriate person with signatory authority, three (3) days in advance of transporting soil off-site. The Contractor shall furnish a form attached to each manifest or other material tracking form for all material removed off-site, certifying that the material was delivered to the site approved for the class of material. If the proposed disposition of the material is for reuse within the project construction corridor, the Contractor shall cooperate with MassDOT to obtain a suitable representative sample(s) of the material to establish its structural characteristics in order to meet the applicable structural requirements as fill for the project.

ITEMS 181.11 thru 181.14 (Continued)

All material transported off-site shall be loaded by the Contractor into properly licensed and permitted vehicles and transported directly to the selected disposal or recycling facility and be accompanied by the applicable shipping paper. At a minimum, truck bodies must be structurally sound with sealed tail gates, and trucks shall be lined and loads covered with a liner, which shall be placed to form a continuous waterproof tarpaulin to protect the load from wind and rain.

DECONTAMINATION OF EQUIPMENT:

Tools and equipment which are to be taken from and reused off site shall be decontaminated in accordance with applicable local, state and federal regulations. This requirement shall include, but not be limited to, all tools, heavy machinery and excavating and hauling equipment used during excavation, stockpiling and handling of contaminated material. Decontamination of equipment is considered incidental to the applicable excavation item, Item 180.4 and Items 181.11-181.14.

REGULATORY REQUIREMENTS:

The Contractor shall be responsible for adhering to regulations, specifications and recognized standard practices related to contaminated material handling during excavation and disposal activities. MassDOT shall not be responsible at any time for the Contractor's violation of pertinent State or Federal regulations or endangerment of laborers and others. The Contractor shall comply with all rules, regulations, laws, permits and ordinances of all authorities having jurisdiction including, but not limited to, Massachusetts Department of Environmental Protection, the U.S. Environmental Protection Agency, Federal Department of Transportation (DOT), Massachusetts Water Resources Authority (MWRA), the Commonwealth of Massachusetts and other applicable local, state and federal agencies governing the disposal of contaminated soils.

All labor, materials, equipment and services necessary to make the work comply with such regulations shall be provided by the Contractor without additional cost to MassDOT. Whenever there is a conflict or overlap within the regulations, the most stringent provisions are applicable. The Contractor shall reimburse MassDOT for all costs it incurs, including penalties and/or for fines, as a result of the Contractor's failure to adhere to the regulations, specifications, recognized standard practices, etc., that relate to contaminated material handling, transportation and disposal.

SUBMITTALS:

I. Summary of Sampling Results, Classification of Material and Proposed Disposal Option. The following information, presented in tabular format, must be submitted to the Engineer for review and approval prior to any reuse on-site or disposal off-site. This requirement is on-going throughout the project duration. At least two weeks prior to the start of any excavation activity, the Contractor shall submit a tracking template to be used to present the information as stipulated below. Excavation will not begin until the format is acceptable to MassDOT.

ITEMS 181.11 thru 181.14 (Continued)

Characterization Reports will be submitted for all soil, sediment, debris and groundwater characterized through the sampling and analysis programs required under Items 180.4, 180.6, and 181.11 – 181.14. Each report will include a site plan which identifies the sampling locations represented in the Report. The Construction Plan sheets may be used as a baseplan to record this information.

The Sampling Results will be presented in tabular format. Each sample will be identified by appropriate identification matching the sample identification shown on the Chain of Custody Record. The sample must also be identified by location (e.g. grid number or stockpile number). For each sample, the following information must be listed: the classification (unregulated, regulated, etc.), proposed disposal option for the stockpile or unit of material represented, and, all analytical results.

Each Characterization Report will include the laboratory analytical report and Chain of Custody Record for the samples included in the Report.

II. Stockpiling, Transport, and Disposal.

At least two weeks prior to the start of any excavation activity, the Contractor shall submit, in writing, the following for review and shall not begin excavation activity until the entire submittal is acceptable to MassDOT.

A. Excavation and Stockpiling Protocol:

Provide a written description of the management protocols for performing excavation and stockpiling and/or direct loading for transport, referencing the locations and methods of excavating and stockpiling excavated material in accordance with Items 180.1 through 180.5.

B. Disposal and Recycling Facilities:

1. Provide the name, address, applicable licenses and approved waste profile for disposal and recycling location(s) where contaminated soil will be disposed. Present information substantiating the suitability of proposed sites to receive classifications of materials intended to be disposed there, including the ability of the facility to accept anticipated volumes of material.
2. Provide a summary of the history of compliance actions for each disposal/recycling facility proposed to be used by the Contractor. The compliance history shall include a comprehensive list of any state or federal citations, notices of non-compliance, consent decrees or violations relative to the management of waste (including remediation waste) at the facility. Material should not be sent to facilities which are actively considered by the DEP, USEPA or other responsible agency to be in violation of federal, state or local hazardous waste or hazardous material regulations. MassDOT reserves the right to reject any facility on the basis of poor compliance history.

ITEMS 181.11 thru 181.14 (Continued)**C. Transportation:**

The name, address, applicable license and insurance certificates of the licensed hauler(s) and equipment and handling methods to be used in excavation, segregation, transport, disposal or recycling.

III. Material Tracking and Analytical Documentation for Reuse/Disposal.

The following documents are required for all excavation, reuse and disposal operations and shall be in the format described. At least two weeks prior to the start of any excavation or demolition activity, the Contractor shall submit the tracking templates required to present the information as stipulated below. Excavation or demolition will not begin until the format is acceptable to MassDOT.

All soils, sediments and demolition debris must be tracked from the point of excavation to stockpiling to onsite treatment/processing operations to off-site disposal or onsite reuse as applicable.

1. Demolition Debris. Demolition debris must be tracked if the debris is stockpiled at a location other than the point of origin or if treatment or material processing is conducted. Identification of locations will be based on the station-offset of the location. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations/comments, quantity, and stockpile ID/processing operation location. For each unit of material tracked, the table will also track reuse of the material on-site, providing reuse date, location of reuse as defined by start and end station, width of reuse location by offset, the fill elevation range, quantity, and finish grade for said location. For demolition debris which is not reused on site, the table will also track disposal of the material as defined by disposal date, quantity and disposal facility. The table must provide a reference to any analytical data generated for the material.
2. Soil/Sediment. Soil excavation will be identified
3. based on the station-offset of the excavation location limits. The tracking table will identify date and point of generation, any field screening such as PID or dust monitoring, visual observations, quantity, and stockpile number/location. For each unit of material tracked, the table will also track reuse of the material on-site and disposal of the material offsite using the same categories identified for demolition debris above.

METHOD OF MEASUREMENT and BASIS OF PAYMENT FOR ITEMS 181.11 THRU 181.14

Disposal of contaminated soil shall be measured for payment by the Ton of actual and verified weight of contaminated materials removed and disposed of. The quantities will be determined only by weight slips issued by and signed by the disposal facility. The most cost-effective, legal disposal method shall be used.

ITEMS 181.11 thru 181.14 (Continued)

Item 181.11 Measurement for Disposal of Unregulated Soil shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved location or licensed facility, and includes any and all costs for approvals, permits, fees and taxes, additional testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.12 Measurement for Disposal of Regulated Soil – In-State Facility shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved in-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.13 Measurement for Disposal of Regulated Soil - Out-of-State Facility shall be under the Contract Unit Price by the weight, in Tons (TN), of contaminated materials removed from the site and transported to and disposed of at an approved out-of-state facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal.

Item 181.14 Measurement for Disposal of Hazardous Waste shall be under the Contract Unit Price by the weight, in Tons (TN), of hazardous waste removed from the site and transported to and disposed of at the licensed hazardous waste facility, and includes any and all costs for approvals, permits, fees and taxes, testing/characterization required by the facility beyond the standard disposal test set, decontamination procedures, transportation and disposal

ITEM 184.1**DISPOSAL OF TREATED WOOD PRODUCTS****TON**

(Rev 01/13/2010)

Work under this item includes disposal of all treated wood removed from former rail bed and the existing bridge, as indicated on the Plans and/or as directed by the Engineer. This item includes all costs for permitting, sampling, laboratory testing, loading, transportation, and disposal of the treated wood to a waste-to-energy facility or similar facility that is licensed to dispose of treated wood.

The timber components of the existing structure and former rail bed are suspected to be treated with creosote, pentachlorophenol and/or CCA. This item shall include all costs for sampling, laboratory testing, loading, transportation and disposal of the treated wood. The Contractor is required to submit disposal manifests to the Engineer prior to the completion of the project. All aspects of this Item are to be completed in accordance with state and federal regulations.

BASIS OF PAYMENT

Measurement and payment shall be by the weight, per TON, of treated timber removed from the structure and rail bed and subsequently accepted at a licensed facility. The work shall be considered full compensation for all labor, tools, equipment, materials, testing, loading, transportation, approvals, and permits necessary for the completion of the work.

ITEM 201.**CATCH BASIN****EACH**

The work to be done under this item shall be done in accordance with the requirements of Section 201 of the Standard Specifications and the following:

New Catch Basin structures shall have a 4-foot minimum deep sump.

ITEM 205.**LEACHING BASIN****EACH**

The work to be done under this item shall be done in accordance with the requirements of Section 201 of the Standard Specifications and the following:

The work under these items shall include furnishing and installing drywells conforming to the details as shown on the plans and as described in these Special Provisions.

BASIS OF PAYMENT

ITEM 205., LEACHING BASIN will be measured and paid for at the contract unit price, per EACH, complete in place and accepted by the Engineer; which payment shall be considered full compensation for all labor, tools, equipment and materials needed to do the work as described above.

Compensation for this work shall include the fabrication, manufacturing, furnishing and installation of the dry well including all backfill material and filter fabric.

ITEM 220.8**SANITARY STRUCTURE REMODELED****EACH**

Work to be performed under this Item shall conform to the relevant provisions of Section 201 of the Standard Specifications, the City of Chelsea Sewer specifications and the following:

Sanitary structures which require a change of more than 6 inches in line and/or grade shall be remodeled. The slope and vertical masonry shall be removed to such depth as required and new masonry shall be constructed to conform to the proposed grades.

The brick for sanitary structures shall be sound, hard and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the Engineer. Brick shall comply with ASTM Standard Specifications for sewer brick (made from clay or shale), Designation C-32-63 or Grade SA, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight. Rejected brick shall be immediately removed from the work and substituted with approved brick.

The existing castings of the structures shall be retained. The cost for removing and resetting frames and covers shall be included in the unit bid price of this item.

ITEM 220.8 (Continued)

All frames and covers shall be set in a concrete collar conforming to Standard Detail E 202.9.0 prior to placement of top course. The concrete collar shall be composed of 4000 PSI, 1- 1/2 Inch, 565 High Early Strength Concrete.

No work shall be performed on any sanitary sewer structure without prior written approval by the City of Chelsea Department of Public Works.

All construction work on the Sewer lines shall be witnessed by a representative from the City of Chelsea Department of Public Works.

Payment for the work to be done under this Item shall be at the Contract Unit Price per EACH, which price shall include full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work, including saw-cutting and/or jack hammering.

ITEM 222.1 **FRAME AND GRATE MASSDOT CASCADE TYPE** **EACH**

The work under this item shall conform to the relevant provisions of Section 200 and the following:

All frames and grates shall be hook lock frames and grates shall conform to Standard Construction Drawings E 201.6.0, E 201.7.0, E 201.7.1, E 201.9.0, E 201.9.1, and E 201.10.0 contained in the 2012 Construction Standard Details and Hook Lock Grates for Catch Basins, available at <http://www.massdot.state.ma.us/Highway>

The Contractor shall determine the number of left and right frames and grates according to the direction of flow and shall provide a list to the Engineer for approval before ordering the castings.

BASIS OF PAYMENT

The work will be paid at the contract price per EACH installed.

ITEM 223.2 **FRAME AND GRATE (OR COVER)** **EACH**
REMOVED AND DISCARDED

The work to be performed under this item shall conform to the relevant provisions of Section 201 and 220; Basins, Manholes and Inlets, amended and supplemented as follows:

Add the following to Subsection 220.61:

All existing castings which are indicated on the Drawings or directed by the Engineer to be removed and discarded, shall become the property of the Contractor and shall be disposed of off the site. The work shall include the removal and disposal of all frames and grates (or covers).

<u>ITEM 303.08</u>	<u>8 INCH DUCTILE IRON WATER PIPE</u>	<u>FOOT</u>
	<u>(MECHANICAL JOINT)</u>	
<u>ITEM 303.12</u>	<u>12 INCH DUCTILE IRON WATER PIPE</u>	<u>FOOT</u>
	<u>(MECHANICAL JOINT)</u>	
<u>ITEM 309.</u>	<u>DUCTILE IRON FITTINGS FOR WATER PIPE</u>	<u>POUND</u>
<u>ITEM 325.24</u>	<u>24 INCH STEEL PIPE CASING FOR WATER PIPE</u>	<u>FOOT</u>
<u>ITEM 345.6</u>	<u>6 INCH TEMPORARY SERVICE PIPE</u>	<u>FOOT</u>
<u>ITEM 355.10</u>	<u>10 INCH GATE AND GATE BOX REMOVED & STACKED</u>	<u>EACH</u>
<u>ITEM 371.08</u>	<u>8 INCH COUPLING</u>	<u>EACH</u>
<u>ITEM 371.10</u>	<u>10 INCH COUPLING</u>	<u>EACH</u>
<u>ITEM 371.12</u>	<u>12 INCH COUPLING</u>	<u>EACH</u>
<u>ITEM 373.12</u>	<u>12 INCH WATER PIPE INSULATION</u>	<u>FOOT</u>
<u>ITEM 376.5</u>	<u>HYDRANT - ADJUSTED</u>	<u>EACH</u>
<u>ITEM 379.1</u>	<u>1 INCH AIR RELEASE VALVE</u>	<u>EACH</u>

The work to be done under these Items shall be in accordance with Section 301 of the Standard Specifications, the City of Chelsea Water Main specifications, and the following:

The Contractor shall be responsible for notifying the Chelsea Water and Sewer Division and the Engineer of service shutdown 48 hours prior to the actual shutdown. Temporary shut-off of service on any existing water mains will be performed by the City of Chelsea Water and Sewer Division. All submissions for the work on water mains, including shop drawings, catalogue cuts, material certifications and test reports, must be approved by the City of Chelsea Department of Public Works.

No water main or service supplying any home, place of business or fire hydrant shall be shut down for more than four hours unless an approved temporary means of supply is provided. Such temporary provisions will be considered as being for the convenience of the Contractor and, as such, will not be measured for direct payment.

Data relative to existing water mains, services, etc. shown on the plans has been compiled from plans and field information but such data is not guaranteed as to exact location or elevation.

All construction work on the water main shall be witnessed by a representative from the City of Chelsea Water and Sewer Division.

Concrete thrust blocks shall be provided at all pipe bends as directed by the Engineer or the representatives of the City of Chelsea.

Provide 12 inch expansion pipe fittings acceptable to the City of Chelsea. Expansion pipe fittings shall be paid for under Item 309 - Ductile Iron Fittings for Water Pipe.

8 inch and 12 inch water pipe shall be Class 52 Ductile Iron (Mechanical Joint) in accordance with City of Chelsea Water Main specifications.

All ductile iron pipe and fittings shall be cement lined in accordance with M5.05.3 of the Standard Specifications.

ITEMS 303.08 thru 379.1 (Continued)

Air release valves shall include furnishing and installing a 1 inch corporation cock. Air release valves required for the water line testing shall be replaced with plug after the water main is accepted. Air release valve at the high point on the bridge shall remain and be protected.

Existing 10 inch water gate and gate box shall be removed and returned to City of Chelsea Water and Sewer Department.

24 inch steel casing pipe shall be Schedule 20 and installed in accordance with MBTA pipeline occupancy specifications. Spacers shall be attached to the 12 inch ductile iron water pipe, attachment to the insulation is not permitted. Payment for the spacers and casing end seals is incidental to the casing pipe.

Contractor is required to perform a leakage test on all the water lines. Payment for the test is incidental to the water work items.

All water mains to be abandoned shall be physically removed and staked or disposed of by the Contractor.

Adjusting the hydrant to the proposed elevation shall be done by adding a stainless steel extension piece designed for this purpose or replacing the standpipe barrel. The safety flange must be set at the proper height per manufacturer's instructions to help prevent further damage to the hydrant should it be hit by a vehicle.

Couplings shall only be allowed when connecting standard outside diameter pipe to oversize or pit cast pipe. The coupling shall be of a type equal to Smith Blair, Style 441; Dresser, Style 253; or Romac Style 501, or an equal approved by the City. Couplings shall be provided with plain, Grade 27, rubber gaskets and with black, steel, track-head bolts with nuts. There shall be zero gaps between proposed water mains and existing water mains within proposed couplings.

ITEMS 303.08 thru 379.1 (Continued)**METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

Water pipe shall be measured in feet, in place, along the axis of the pipe, excluding, however, the length occupied by new iron fittings and gate valves. Where two pipes join, measurement will be made to the intersection of the axis, excluding the length occupied by new ductile iron fittings.

New ductile iron fittings including socket clamps and tie rods shall be measured by the pound and the quantity to be paid for shall be the weight stated on the invoice of the supplier, or the manufacturer's rated weight as listed in the catalog, whichever is the least weight.

Payment for ductile iron pipe shall be made at the contract unit price per foot for water main of the size shown, which price shall be full compensation for the removal and disposal of existing water pipe and appurtenances encountered during construction, cutting and plugging the existing water pipe, and furnishing all materials, preparation and installation, including all excavation and backfilling, pipe bedding, testing and disinfecting, cement lining, and for all labor, equipment, tools and incidentals necessary.

Payment for new ductile iron fittings shall be made at the contract unit price per pound of fitting installed and accepted, which price shall be full compensation for furnishing all materials, and for all labor, equipment, tools and incidentals necessary to complete the item, including all excavation and backfilling, pipe bedding, testing and disinfecting.

Payment for adjusting hydrants shall be made at the contract unit price per each which price shall be full compensation for furnishing all materials, and for all labor, equipment, tools and incidentals necessary to complete the item, including all excavation and backfilling, pipe bedding, testing and disinfecting.

The cost of furnishing and installing concrete for thrust blocks shall be paid for under ITEM 903.

ITEM 415.**PAVEMENT MICROMILLING****SQUARE YARD**

All references to Section 130 Pavement Milling within Section 450 Hot Mix Asphalt Pavement shall be replaced by Item 415 Pavement Micromilling.

Description**415.20 General.**

This work shall consist of micromilling and removal of existing Hot Mix Asphalt (HMA) pavement courses from the project by the Contractor. Micromilling shall be performed in conformity with the approved QC Plan. The Contractor shall present and discuss in sufficient detail the Quality Control information and activities related to milling at the Construction Quality Meeting required under Section 450. Unless otherwise specified, the milled material shall become the property of the Contractor.

Construction Procedures**415.60 General.**

All construction procedures under Pavement Micromilling shall also conform to any of the following relevant provisions of Pavement Milling:

Milling Equipment Requirements.

The milling equipment shall be self-propelled with sufficient power, traction, and stability to remove the existing HMA pavement to the specified depth and cross-slope. The milling machine shall be capable of operating at a minimum speed of 10 feet (3 meters) per minute, designed so that the operator can at all times observe the milling operation without leaving the control area of the machine, and equipped with the following:

- (a) A built in automatic grade control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results.
- (b) Longitudinal controls capable of operating from any longitudinal grade reference, including string line, 30 foot (10 meter) ski minimum, 30 foot (10 meter) mobile string line minimum, or a matching shoe.
- (c) The transverse controls shall have an automatic system for controlling cross-slope at a given rate.
- (d) Cutting heads able to provide a minimum 6 foot (2 meter) cutting width and a 0 to 4 inch (0 to 100 mm) deep cut in one pass. The teeth on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.
- (e) An integral pickup and conveying device to immediately remove milled material from the roadway and discharge the millings into a truck, all in one operation.
- (f) All necessary safety devices such as reflectors, headlights, taillights, flashing lights and back up signals so as to operate safely in both day and night.
- (g) A means of effectively limiting the amount of dust escaping from the milling and removal operation in accordance with local, State, and Federal air pollution control laws and regulations.

ITEM 415. (Continued)

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a smaller or lesser-equipped milling machine may be permitted when approved by the Engineer.

Sweeper Equipment Requirements.

The Contractor shall provide a sufficient number of mechanical sweepers to ensure that the milled surface is free of millings and debris at the end of each day's milling operations. Each sweeper shall be equipped with a water tank, spray assembly to control dust, a pick-up broom, a dual gutter broom, and a dirt hopper. The sweepers shall be capable of removing millings and loose debris from the textured pavement.

Milling Operations.

The milling operations shall be scheduled to minimize the duration and placement of traffic on the milled surface. The milling operations shall not proceed more than 3 miles ahead of the paving operations. Under no circumstances shall the milled surface be left exposed to traffic for a period exceeding seven days. The Engineer may allow the Contractor to adjust the above limitations on milling production when necessary.

The Contractor shall coordinate milling and paving operations to minimize the exposure of milled surfaces to traffic. The Contractor shall ensure that milled surfaces are overlaid in a timely manner to avoid damage to the pavement structure. Any damage to the pavement structure resulting from extended exposure of the milled surface to traffic shall be repaired as directed by the Engineer at the Contractor's expense.

The existing pavement shall be removed to the average depth shown on the plans, in a manner that will restore the pavement surface to a uniform cross-section and longitudinal profile. The longitudinal profile of the milled surface shall be established using a 30 foot (10 meter) mobile ski, mobile string line, or stationary string line. The cross-slope of the milled surface shall be established by a second sensing device or by an automatic cross-slope control mechanism. The Contractor will be responsible for providing all grades necessary to remove the material to the proper line, grade, cross section, superelevation, and transitions shown on the plans or as directed by the Engineer. The requirement for automatic grade or slope controls may be waived by the Engineer in locations warranted by the situation, including intersections and closely confined areas.

The Engineer may adjust the average milling depth specified on the plans by $\pm 3/4"$ ($\pm 20\text{mm}$) during each milling pass at no additional payment to minimize delamination of the underlying pavement course or to otherwise provide a more stable surface. If delamination or exposure of concrete occurs when milling a HMA pavement course from an underlying Portland Cement Concrete (PCC) pavement, the Contractor shall cease milling operations and consult the Engineer to determine whether to reduce the milling depth or make other adjustments to the operation.

ITEM 415. (Continued)**Protection Of Inlets And Utilities.**

Throughout the milling operation, protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense. To prevent the infiltration of milled material into the storm sewer system the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that falls into inlet openings or inlet grates shall be removed at the Contractor's expense.

Vertical Faces.

All permanent limits of the milled area shall be sawcut or otherwise neatly cut by mechanical means to provide a clean and sound vertical face. No vertical faces, transverse or longitudinal, shall be left exposed to traffic. If any vertical face is formed in an area exposed to traffic a temporary paved transition with a maximum 12:1 slope shall be established. If the milling machine is used to temporarily transition the milled pavement surface to the existing pavement surface, the temporary transition shall be constructed at a maximum 12:1 slope.

Opening To Traffic.

Prior to opening a milled area to traffic, the milled surface shall be thoroughly swept with a mechanical sweeper to remove all remaining millings and dust. This operation shall be conducted in a manner so as to minimize the potential for creation of a traffic hazard and to comply with local, State, and Federal air pollution control laws and regulations. Any damage to vehicular traffic as a result of milled material becoming airborne is the responsibility of the Contractor and shall be repaired at the Contractor's expense. Temporary pavement markings shall be placed in accordance with the provisions of Subsection 850.64.

Milled Surface Inspection.

The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced shall be corrected by remilling at the Contractor's expense and to the satisfaction of the Engineer.

The Contractor shall perform Quality Control inspection of all work items addressed as specified in the table below. Inspection activities during milling of HMA pavement may be performed by qualified Production personnel (e.g. Skilled Laborers, Foremen, Superintendents). However, the Contractor's QC personnel shall have overall responsibility for QC inspection. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes. The Engineer shall be provided the opportunity to monitor and witness all QC inspection.

ITEM 415. (Continued)

The milled surface of each travel lane shall be divided into longitudinal Sublots of 500 feet (150 meters). The Contractor shall perform a minimum of one random QC measurement within each Sublot with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. Additional selective QC measurements within each Sublot will be performed as deemed necessary by the QC personnel. All QC inspection results shall be recorded on NETTCP Inspection Report Forms. The Engineer will also randomly inspect a minimum of 25% of the Sublots. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

In isolated areas where surface delamination between existing HMA layers or a surface delamination of HMA on Portland Cement Concrete causes a non-uniform texture to occur, the straightedge surface measurement requirements stated in the preceding paragraph may be waived, subject to the approval of the Engineer.

Minimum QC Inspection of Milling Operations

Inspection Component	Items Inspected	Minimum Inspection Frequency	Point of Inspection	Inspection Method
Equipment	As specified in QC Plan	Per QC Plan	Per QC Plan	Per QC Plan
Environmental Conditions	Protection of Inlets & Utilities	Per QC Plan	Existing Surface	Visual Check
	Removal of Millings & Dust	Per QC Plan	Milled Surface	Visual Check
Workmanship	Milling Depth	Per QC Plan	Milled Surface	Check Measurement
	Cross-Slope & Profile	Per QC Plan	Milled Surface	Check Measurement
	Milled Surface Texture	Per QC Plan	Milled Surface	Visual Check
	Milled Surface Roughness	Once per 500 feet(150 meters) per milled lane	Milled Surface per Subsection 410.67	10 foot (3 meter) standard straightedge
	Sawcut Limit Vertical Face	Per QC Plan	Sawcut Limits	Visual Check

ITEM 415. (Continued)**415.61 Micromilling Equipment Requirements.**

The micromilling machine shall be equipped with a drum specifically designed to provide the surface specified below.

415.62 Control Strip.

The Contractor shall micromill a control strip. The control strip shall be 500 feet minimum in length with a uniformly textured surface and cross slope, as approved by the Engineer.

The micromilled surface of the control strip shall provide a satisfactory riding surface with a uniform textured appearance. The micromilled surface shall be free from gouges, excessive longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, non-uniform milling teeth, improper use of equipment, or otherwise poor workmanship. Any unsatisfactory surfaces produced in the control strip shall be corrected by additional micromilling at the Contractor's expense and to the satisfaction of the Engineer.

The micromilled pavement surface shall have a transverse pattern of 0.2 – 0.3 inch center to center of each strike area. The Contractor shall perform surface texture measurements with a 10 foot (3 meter) straightedge in the transverse direction across the milled surface. The milled surface shall have a texture such that the variation from the edge of the straightedge to the top of ridges between any two ridge contact points shall not exceed 1/8 inch (3 mm). The difference in height from the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed 1/16" (1.6 mm). Any point in the surface not meeting these requirements shall be corrected as directed by the Engineer at the Contractor's expense.

415.67 Micromilled Surface Inspection.

The Contractor shall perform Quality Control inspection of all work items addressed under Section 415. The Contractor shall not rely on the results of Department Acceptance inspection for Quality Control purposes.

The micromilled surface shall meet the requirements of 415.62.

Compensation**415.80 Method of Measurement.**

Micromilling - Micromilling will be measured for payment by the number of square yards (square meters) of area from which the milling of existing HMA pavement has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar utility structures.

ITEM 415. (Continued)**415.81 Basis Of Payment**

Micromilling - Micromilling, removal and disposal of existing HMA pavement will be paid for at the contract unit price per square yard (square meter). This price shall include all equipment, tools, labor, and materials incidental thereto. No additional payments will be made for multiple passes with the milling machine to remove the existing HMA surface to the grade specified.

No separate payments will be made for: performing handwork removal of existing pavement and providing protection around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractor's negligence; providing protection to underground utilities from the vibration of the milling operation; sawcutting micromilled limits; installing and removing any temporary transition; removing and disposing of millings; furnishing a sweeper and sweeping after milling. The costs for these items shall be included in the contract unit price for Pay Item 415., Pavement Micromilling.

415.82 Payment Items.

415.	Pavement Micromilling	Square Yard
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<u>ITEM 440.</u>	<u>CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL</u>	<u>POUND</u>
<u>ITEM 443.</u>	<u>WATER FOR ROADWAY DUST CONTROL</u>	<u>MGL</u>

The work to be done under these Items shall be in accordance with Section 440 of the Standard Specifications and the following:

General

The Contractor is responsible for controlling construction related dust emissions at all times during work of this Contract, 24 hours per day, 7 days per week, including nonworking hours, weekends, and holidays. Work shall be conducted in a manner that will not result in nuisance dust conditions (i.e., visible airborne dust cloud).

Submittals

Prior to starting any work the Contractor shall develop and submit for approval a dust control plan that outlines in detail the measures to be implemented. The plan shall be incidental to the work and shall include details as to how dust emissions will be controlled and/or minimized for demolition activities, earthwork activities including excavation, stockpiling of material, and transportation on public roadways.

Materials

The material for this work shall be of the kind described below, shown on the plans and shall meet the requirements of the following Subsections of Division III, Materials:

Water	M4.02.04
Calcium chloride	M9.01.0

Soil stabilizer shall be non-toxic, non-corrosive, and environmentally safe.

Wind screens shall be a durable fabric mesh of 50 percent porosity, attached to a fence.

Wind barriers shall be solid wood panels, solid durable fabric attached to a fence, or other solid barriers intended to block the passage of wind.

Covers for stockpiles shall be UV resistant plastic tarps with a minimum 4 mil thickness.

Seeding for Erosion Control shall conform to M6.03.1

Construction Methods

Construction Site Dust Control

Water or calcium chloride shall be used to provide dust control.

ITEMS 440. & 443. (Continued)

The Contractor shall apply water as necessary, or as directed by the Engineer to control dust. Several applications per day may be necessary to control dust depending on weather conditions and the work activity being performed.

Soil stabilizers such as polymer emulsion based products shall be applied per the manufacturer directions for the area where dust control is needed.

Both water and soil stabilizer application equipment shall consist of sprinkler pipelines, tanks, tank trucks, or other devices that are capable of providing regulated flow, uniform spray, and positive shut-off.

Calcium chloride shall be applied at a rate of 1.5 pounds per square yard, or as directed by the Engineer to control dust.

Water shall not be applied to any roadway surface when freezing conditions occur.

The Contractor shall ensure that vegetation and the soil to be used for vegetation are not treated. The use of petroleum products for dust suppression is prohibited.

Wind screens and/or wind barriers shall be provided in locations where they would be effective in minimizing the spread of dust. The location of wind screen and/or wind barrier placement shall be submitted as part of the Contractor's dust control plan. For pedestrian sidewalks that are located immediately adjacent to an active work zone, wind barriers should be used and placed between the active work zone and the pedestrian sidewalk. Both wind screens and wind barriers can be moved as necessary as the active work area shifts within a work zone. The Contractor shall keep wind screens and wind barriers in good repair for the life of the contract.

Compressed air for cleaning debris from any surface or structure will be permitted only when in compliance with the approved dust control plan.

Only wet cutting of concrete block, concrete and/or asphalt surfaces is allowed.

Public Roadway Dust Control

Vehicles leaving the construction site shall have no mud or dirt on the vehicle body or wheels.

Haul truck cargo areas shall be securely covered during material transport on public roadways.

Material with high water content shall not be allowed to leak from truck cargo areas during transport over public roadways.

Vehicle mud and dirt carryout, material spills and soil wash-out onto public roadways and walkways and other paved areas shall be immediately cleaned up by the Contractor.

ITEMS 440. & 443. (Continued)

At work zone egress points, the Contractor shall use power sweeping which consists of vacuuming, wet power sweeping, regenerative air sweeping, or wet power broom sweeping on paved roadways. Dry sweeping is prohibited.

Control of Earthwork Dust

During batch drop operations (i.e., earthwork with front-end loader, clamshell bucket, or backhoe) the free drop height of excavated or aggregate material shall be minimized to prevent the generation of dust.

To prevent spills during transport, freeboard space shall be maintained between the material load and the top of the truck cargo bed rail.

Control of Stockpile Dust

The Contractor shall employ one or more of the following methods to prevent the release of dust from stockpiles. The method to be used shall be submitted for review and approval as part of the dust control plan specified under Submittals.

- a. Water shall be used during active stockpile load-in, load-out and maintenance activities;
- b. UV resistant plastic tarps on stockpiles, secured with sandbags or an equivalent method to prevent the covers from being dislodged by the wind. The Contractor shall repair or replace covers whenever damaged or dislodged, without additional compensation,
- c. Soil stabilizers applied to the surface of inactive stockpiles,
- d. Seeding shall consist of hydroseeding inactive stockpiles. Seeding shall conform to M6.03.1.

Demolition Dust Control Measures

Water shall be used during demolition.

During transport of demolition debris, the truck cargo area shall be securely covered

<u>ITEM 450.90</u>	<u>CONTRACTOR QUALITY CONTROL</u>	<u>TON</u>
<u>ITEM 451.</u>	<u>HMA FOR PATCHING</u>	<u>TON</u>
<u>ITEM 452.</u>	<u>ASPHALT EMULSION FOR TACK COAT</u>	<u>GAL</u>
<u>ITEM 453.</u>	<u>HMA JOINT SEALANT</u>	<u>FT</u>
<u>ITEM 455.22</u>	<u>SUPERPAVE SURFACE COURSE 9.5 (SSC-9.5)</u>	<u>TON</u>
<u>ITEM 455.32</u>	<u>SUPERPAVE INTERMEDIATE COURSE 19.0 (SIC-19.0)</u>	<u>TON</u>
<u>ITEM 455.42</u>	<u>SUPERPAVE BASE COURSE 37.5 (SBC-37.5)</u>	<u>TON</u>
<u>ITEM 455.60</u>	<u>SUPERPAVE BRIDGE SURFACE COURSE 9.5 (SSC-B-9.5)</u>	<u>TON</u>
<u>ITEM 455.71</u>	<u>SUPERPAVE BRIDGE PROTECTIVE COURSE 12.5 (SPC-B-12.5)</u>	<u>TON</u>

Work under these Items shall conform to the relevant provisions of Document 00717 SUPERPAVE REQUIREMENTS contained herein and the following:

The Equivalent Single Axle Loads (ESALs) for the design travel lane of the Silver Line Gateway (Busway) over a 20-year period is **14.6 Million 18-kip (80-kn) ESALs** which corresponds to a **Superpave Mix Design Level 4**.

The Equivalent Single Axle Loads (ESALs) for the design travel lane of the Silver Line Gateway (Busway) when combined with the maximum ESALs on Local Streets at the crossings over a 20-year period is **7.3 Million 18-kip (80-kn) ESALs** which corresponds to a **Superpave Mix Design Level 3**.

The Equivalent Single Axle Loads (ESALs) for the design travel lane of the Washington Avenue and Heard Street over a 20-year period is between **7.3 Million 18-kip (80-kn) ESALs** which corresponds to a **Superpave Mix Design Level 3**.

The asphalt binder used for all Superpave Surface Course 9.5 (SSC-9.5), Superpave Intermediate Course 19.0 (SIC-19.0), Superpave Bridge Surface Course 9.5 (SSC-B-9.5) and Superpave Bridge Protective Course 12.5 (SPC-12.5) mixtures for this contract shall be a PG64V-28.

The asphalt binder used for all Superpave Base Course 37.5 (SBC-37.5) HMA mixtures for this contract is a PG64S-28.

The asphalt binder shall meet requirements of PG 64-28, Grade V or S as specified in AASHTO MP 19. The non-recoverable creep compliance versus percent recovery of the binder shall fall above the curve in Figure X2.1 in Appendix X2 of AASHTO TP 70 when plotted. All references in Section 450 and Section 455 referring to AASHTO M 320 shall be replaced with AASHTO MP 19. The Superpave HMA mixture shall have a certificate of analysis with the AASHTO MP 19 test results.

ITEM 454.5**LATEX MODIFICATION OF HMA****TON**

The purpose of this Item is to latex-modify the Superpave Surface and Intermediate Courses. Item 454.5 includes the cost of the latex, costs associated with injecting the latex into the HMA plant and incidentals. Costs for HMA production and placement is compensated under Section 450 and Section 455.

Mix Design

The latex polymer modifier type and amount shall be included as part of the job mix formula. The Superpave Hot Mix Asphalt mixtures shall be produced with asphalt binder modification as follows:

Latex Polymer Modified Asphalt Binder

The polymer additive shall consist of unvulcanized Styrene Butadiene Rubber (SBR) in liquid latex form, with a minimum quantity of rubber solids of 3% by weight of the performance grade asphalt binder (PGAB) content of the mix. The PG 64-28 shall be modified to produce a PGAB grade of 70-28.

Quantity: 3% rubber solids by weight of the bitumen content of the mix. (Example: If the latex polymer is 70% solids, weight per gallon is 7.69 lbs = 5.38 lbs solids per gallon. If mix calls for 6% bitumen, 3% = 3.6 lbs of latex solids per ton mix or 0.70 gallons of latex per ton of mix.)

The latex polymer modified asphalt binder shall be injected into the mix at the time of manufacture. In a drum plant, the liquid latex polymer shall be pumped into the asphalt binder through a spud welded to the asphalt binder line just prior to where it enters the drum. The constant rate at which the latex polymer is pumped shall be determined by the mix speed of the drum. In a batch plant, the polymer is pumped directly into the mix five (5) seconds after the asphalt binder starts to dump into the pug mill. Mix time per batch after polymer is pumped in is 45 to 60 seconds. The plant shall be equipped with an in-line blender and a sample cock for Quality Control and Acceptance purposes.

A metering system shall be attached to a printer which prints a time and date stamp, latex flow rate and cumulative polymer usage during the HMA production, allowing the Engineer to reference the injection rate and latex used against the plant's projection rate. The printout shall be set for a five minute interval. The latex polymer manufacturer will have a professional representative available at the HMA plant during the first day of mix production and placement, and as required thereafter by the Engineer.

The manufacturer of the SBR latex shall provide certified test results for Styrene Butadiene ratio, total rubber solids percentage by weight, pH, ash content, and viscosity to the Engineer prior to mix production.

Mix conforming to the requirements of these Special Provisions shall be placed when the ambient temperature is 50°F and rising when measured in the shade away from artificial heat.

Mixing temperature shall be 290°F to 325°F unless otherwise specified by the Engineer. Mix shall be placed at between 275°F and 310°F.

ITEM 454.5 (Continued)

METHOD OF MEASUREMENT

ITEM 454.5, HMA LATEX MODIFICATION OF HMA shall be measured by the TON of hot mix asphalt modified with latex.

BASIS OF PAYMENT

ITEM 454.5, LATEX MODIFICATION OF HMA will be paid per TON of HMA modified with a latex modifier, which price shall include all costs of the latex, equipment, labor, manufacturer's representative, and all incidental costs required to modify the HMA.

Costs for the Superpave HMA production, placement and QC are compensated under the respective Superpave pay items.

ITEM 456.**WARM-MIX ASPHALT PAVEMENT****TON**

All SUPERPAVE Hot Mix Asphalt Mixtures shall be modified using a WMA additive capable of lowering plant production temperatures to below 260° F. Warm Mix Asphalt additives reduce compaction effort and permit lower production temperatures than conventional hot mix asphalt. The WMA additive shall be a product listed on the Northeast Asphalt User Producer Group (NEAUPG) website (<http://www.superpave.psu.edu/NEAUPG.html>), except that no WMA foaming technology will be permitted which requires the mechanical injection of steam or water into the liquid asphalt.

The WMA additive must be compatible with polyphosphoric acid modified binders, polymer modified binders, and the HMA producer's HMA anti-stripping agents. The WMA additive shall be introduced in accordance with the Manufacturer's dosing rates and approved blending methods. The WMA additive Manufacturer shall have an on-site representative at the beginning of paving operations. The Manufacturer's representative shall be available for additional consultation during the remaining Warm Mix production.

All work done under this Item shall conform to the provisions of Sections 450 and 455. The WMA mixture design shall incorporate the requirements of NCHRP Report 691: Mix Design Practices for Warm Mix Asphalt "*Draft Appendix to AASHTO R35, Special Mixture Design Considerations and Methods for Warm Mix Asphalt (WMA)*". In addition to the provisions of Sections 450 and 455, laboratory prepared samples that have been manufactured at specified temperatures with and without the WMA additive shall be submitted to MassDOT at least 45 days prior to placement for testing. These samples shall be subject to Hamburg Wheel testing for moisture damage and rutting for verification that the WMA is at least equal in performance to the HMA. Preparation of these samples shall be coordinated with the MassDOT.

All WMA additive equipment shall be fully automated and integrated into the plant controls.

The HMA QC Plan shall incorporate the modification of asphalt binders when the WMA additive is blended with the asphalt binder at the plant. This plan shall conform to the most current Northeast Asphalt User Producer Group (NEAUPG) binder testing requirements and specifically address WMA metering requirements, tolerances and other QC measures.

All costs associated with these provisions will be considered incidental to Item 456. No additional compensation will be provided for the Manufacturer's representative, production of samples, the Warm Mix additive or other incidental costs.

METHOD OF MEASUREMENT

ITEM 456., WARM-MIX ASPHALT PAVEMENT shall be measured by the TON of hot mix asphalt modified with warm-mix additive.

BASIS OF PAYMENT

ITEM 456., WARM-MIX ASPHALT PAVEMENT will be paid per TON of HMA modified with a WMA additive, which price shall include all costs of the WMA Additive, equipment, labor, manufacturer's representative, and incidental costs required to modify the HMA. Costs for the Superpave HMA production, placement and QC are compensated under the respective pay items.

ITEM 472.01**IMPRINT CROSSWALKS****SQUARE FOOT****DESCRIPTION**

The work under this item shall conform to the relevant provisions of Section 400 of the Standard Specifications and the following:

The work shall consist of the furnishing and installing of Imprint Crosswalk materials as part of the crosswalk installations within the limits of work (note that the drawings refer to Imprint Crosswalks as “Stamped Concrete Crosswalk”, and that these terms are interchangeable). The work shall consist of furnishing and placing a High Friction Surface Treatment (HFST) on asphalt or concrete pavements.

The HFST shall be comprised of surface preparation and a minimum of a single layer using a Binder Resin System which holds a surface applied aggregate firmly in place. The Binder Resin System shall include Polymeric or Methyl Methacrylate (MMA) Resins.

MATERIALS**Resin Binder System**

Resin Binder Systems shall be recommended by the manufacturer as suitable for use on the intended pavement surface and for the potential range of atmospheric exposure.

The Contractor shall furnish and install a Resin Binder System that meets the criteria in Table 1:

Table 1 - Resin Binder System			
Property	Test Method	Requirements	
		Polymeric Resin	MMA
Ultimate Tensile Strength	AASHTO M-235	2000-5000 psi	1500-5000 psi
Elongation at break point	AASHTO M-235	30-70%	30-70%
Compressive Strength	ASTM C-579	1600 psi min.	1600 psi min.
Compressive Strength	AASHTO M-235	1000 psi min. at 3 hours 5000 psi min. at 7 days	1000 psi min. at 3 hours 2000 psi min. at 7 days
Water Absorption	AASHTO M-235	1% max.	1% max.
Durometer Hardness (Shore D)	ASTM D-2240	60-80	40-75
Viscosity	ASTM D-2556	Class C: 7-30 poises	Class C: 12-20 poises
Gel Time	AASHTO M-235	Class C: 10 minutes min.	Class C: 10 minutes, min.
Cure Rate (Dry through time)	ASTM D-1640	3 hrs. max.	3 hrs. max.
Adhesive Strength at 24 hours	ASTM D-4541	250 psi min. or 100% substrate failure	250 psi min. or 100% substrate failure

ITEM 472.01 (Continued)

Independent laboratory reports per formulation shall be provided, documenting that the resin binder meets the requirements of this specification. A sample of the resin binder or components lot/batch shall be provided a minimum of 14 days prior to the commencement of work.

At the request of the Engineer, the manufacturer of the Resin Binder System shall certify that the Resin Binder System meets the requirements of this specification. Such certification shall consist of either a copy of the manufacturer's test report or a statement by the manufacturer, accompanied by a copy of the current test results, that the Resin Binder System has been sampled and tested. Such certification shall indicate the date of testing and shall be signed by the manufacturer.

Aggregate

The Contractor shall furnish and install a high friction aggregate that is clean, dry and free from deleterious material. The high friction aggregate shall be Calcined Bauxite.

The calcined bauxite aggregate shall meet the properties shown in Table 2:

Table 2 - Calcined Bauxite Aggregate		
Property	Test Method	Requirement
Polish Stone Value	AASHTO T-279	65 min.
Resistance to Degradation	AASHTO T-96	20% max.
Aggregate Grading	AASHTO T-27	No. 4 Percent Passing 100% min. No. 6 Percent Passing 95% min. No. 16 Percent Passing 5% max.
Moisture Content	AASHTO T-255	0.2% max.
Aluminum Oxide	ASTM C-25	87% min.

All aggregates shall be furnished in appropriate packaging that is clearly labeled and protects the aggregate from any contaminates on the jobsite and from exposure to rain or other moisture.

Unless the HFST is on the MassDOT Qualified Products List, the manufacturer shall provide a 50 lb bag of aggregate accompanied to the DOT for approval a minimum of 14 days prior to the commencement of work. On all projects and regardless of the HFST status on the MassDOT Qualified Products List, the manufacturer of the aggregate shall certify that the aggregate meets the requirements of this specification. Such certification shall consist of either a copy of the manufacturer's report or a statement by the manufacturer, accompanied by a copy of the current test results, that the aggregate has been sampled and tested. Such certification shall indicate the date of testing and shall be signed by the manufacturer.

CONSTRUCTION METHODS

A manufacturer's representative of the Resin Binder System shall be present at the jobsite during all construction operations relating to the preparation and placement of the HFST. All construction operations relating to the HFST shall meet the recommendations of the manufacturer's representative. Final approval of all HFST placement operations will be given by the engineer.

ITEM 472.01 (Continued)**Weather Limitations**

Resin Binder system shall not be placed on any wet surface or when the ambient temperature or the temperature of the pavement is below the manufacturer's recommendations or when the anticipated weather conditions would prevent the proper application of the surface treatment as directed by the manufacturer's representative.

Surface Preparations

The surface shall be thoroughly cleaned immediately prior to installation of the HFST. The surface shall be clean, dry and free of all dust, oil, debris and any other material that might interfere with the bond between the resin binder material and the existing surface as recommended by the manufacturer's representative. HFST may not be placed on any new HMA pavement that has been placed in the previous 30 days with motor vehicle traffic or 60 days without motor vehicle traffic.

The Contractor shall pre-treat joints and crack greater than ¼ inch in width and depth with the mixed Resin Binder System. Once the resin binder in the pre-treated areas has gelled, the installation of the HFST may proceed.

Surface preparation work, surface temperature and placement of the HFST shall be in conformance with the binder supplier's specifications and as approved by the manufacturer's representative.

All existing edge line pavement markings that are adjacent to the HFST location shall be covered and protected as approved by the engineer prior to performing surface preparation. HFST shall not be placed over existing pavement markings or rumble strips. Lane line pavement markings that conflict with the HFST installation shall be removed by methods approved by the manufacturer's representative. Any existing edge line pavement markings that are damaged during the HFST application process shall be replaced at the contractor's expense.

HFST shall be allowed to cure for the minimum duration as recommended by the binder component supplier's specifications and during that time the application area shall be closed to all vehicles and contractor's equipment traffic. After placement and cure of the HFST, the contractor shall test the finished surface in accordance with ASTM D7234 to detect unbonded areas.

Excess and loose aggregate shall be removed from the traveled way and shoulders in such a way that the HFST is not damaged or disturbed. Excess aggregate that can be reused shall be reclaimed by a Vacuum sweeper. The recovered aggregate shall be clean, uncontaminated and dry, if it is to be re-used in the HFST application.

Utilities, drainage structures, curbs and any other structures within or adjacent to the treatment location shall be protected against the application of the HFST materials.

HFST shall not be applied to newly placed asphalt pavement surfaces that are less than 30 days old, unless the surface is sandblasted as approved by the manufacturer's representative, prior to application.

ITEM 472.01 (Continued)**Surface Friction Test**

The surface friction of the completed HFST shall meet a minimum requirement of 65 FN40R from the ASTM E274 test. MassDOT-Highway Division will perform this test within 7 calendar days after completion of the HFST.

Any surface that fails to conform to the above friction requirement must be removed and replaced at the Contractor's expense within 24 hours after being notified by the engineer.

Application Methods

HFST shall be applied in accordance with the manufacturer's recommendations. The HFST can be applied by either mechanical or manual techniques.

The Resin Binder System shall be blended and mixed in the ratio per the manufacturer's specification (+/- 2% by volume) and shall be continuously applied once blended.

The Resin Binder System shall be applied at a uniform thickness of 50-65 mils (25-32 square feet per gallon). Coverage rate is based upon expected variances in the surface profile of the pavement.

The operation shall proceed in such a manner that will not allow the mixed material to separate, cure, dry, be exposed or otherwise harden in such a way as to impair retention and bonding of the high friction aggregate.

The high friction aggregate shall be immediately applied at a rate of 12-15 pounds per square yard (achieving saturation) in such a manner that there is no disruption to the leveled binder. It is the responsibility of the contractor to ensure full embedment of the high friction aggregate.

Wet spots shall be covered with the high friction aggregate prior to the gelling of the Resin Binder System.

Walking, standing on, or any form of contact or contamination with the wet uncured Resin Binder System, prior to application of the aggregate, will result in that section of Resin Binder System being removed and replaced at the Contractor's expense.

Texturized Decorative Surfacing

The Contractor shall be responsible for the preparation, placement and patterning of IMPRINT. This paving material shall be formulated with a color stable pigment throughout, which can be surface textured to simulate hand laid brick, stone and/or masonry. The Contractor will be required to overlay IMPRINT in previously prepared pavement surfaces as described in the Section above.

The Contractor must be a manufacturer authorized applicator, experienced with this specialized system satisfactory to MassDOT or the City of Chelsea.

ITEM 472.01 (Continued)

The work shall be performed in the following general manner:

- Using manufacturer prescribed methods and equipment, the Contractor shall adequately heat and uniformly mix the IMPRINT material(s) together.
- Color and pattern shall be as shown on the plans.
- The Contractor shall then apply the mixed IMPRINT material to the surface of a hardened, structurally sound bituminous concrete or cement concrete pavement, as directed.
- The IMPRINT material shall be spread to the desired build thickness using specialized ironing tools, heated sufficiently to smooth the surface to a state of readiness for texturizing.
- The color, texture and surface pattern shall be in accordance with the details shown on the plans.
- Once the finished surface has cooled sufficiently, the application area may be opened to vehicular and/or pedestrian traffic.
- Any residue resulting from this work shall be removed and disposed of in a proper manner. The completed work area is to be left in a neat and clean condition, satisfactory to the City and the Engineer.
- The Contractor will provide police protection when necessary. The Contractor will be responsible for furnishing and placing a sufficient number of safety cones to adequately protect all work zones, and to insure the orderly flow of vehicular and pedestrian traffic.
- Special care must be exercised by the Contractor during the operation of work to save from harm and injury, any structure, public or private, situated above or below the surface and lying within the scope of the project. If during the execution of the work, the contractor, through willfulness or carelessness, permits or causes any damage, the cost of satisfactory repair or replacement shall be the financial responsibility of the Contractor.

METHOD OF MEASUREMENT

ITEM 472.01, IMPRINT CROSSWALKS shall be measured for payment per SQUARE FOOT, complete in place.

BASIS OF PAYMENT

ITEM 472.01, IMPRINT CROSSWALKS shall be paid for at the respective contract unit price per SQUARE FOOT, which price shall include all labor, material, equipment, mobilization, mock-up, and incidental costs required to complete the work.

There will be no additional compensation for the disposal of excavated materials or excess Imprint materials. No deductions will be made for structures within the work area such as manholes, catch basins, or water covers.

ITEM 482.3**SAWING ASPHALT PAVEMENT****FOOT**

The work under this item shall include the saw-cutting of existing pavements which are to remain at limits of sidewalk construction, wheelchair ramp construction as shown on the plans and as directed by the Engineer. Saw cutting shall be full depth through the existing material.

Saw cutting equipment shall be approved by the Engineer prior to commencing work.

All edges of excavations made in existing pavements, driveways, and sidewalks which will not be overlaid and which will be visible shall be squared by saw-cutting with power-driven tools to provide a neat, clean edge for joining new pavement and sidewalks as shown on the Plans. Ragged, uneven edges shall not be accepted. Areas which have been broken or undetermined shall be edged neatly with a minimum disturbance to remaining pavement or sidewalks.

Saw-cut surfaces shall be sprayed or painted with a uniform thin coat of RS-1 asphalt emulsion immediately before placement of bituminous concrete material against the surface.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Sawing pavements and sidewalk joints will be measured for payment by the FOOT on the pavement surface complete in place.

Sawing pavements and sidewalk joints will be paid for at the contract unit price per FOOT, which price shall include all labor, materials, equipment, and incidental costs required to complete the work.

No separate payment will be made for saw-cutting required for the installation of conduit, but all costs in connection therewith shall be included in the unit price bid for their respective items.

ITEM 486.1 SCORED CEMENT CONCRETE PAVEMENT SQUARE YARD

The work under this Item shall conform to the relevant provisions of Section 476 of the Standard Specifications and the following:

The work shall consist of a scored cement concrete pavement composed of air entrained Portland cement concrete as specified, constructed on an approved foundation in accordance with the Standard Specifications and these Special Provisions. The pavement shall be installed at locations indicated on the plans and as directed by the Engineer.

The scored concrete pavement shall consist of a 10 inches of cement concrete pavement over 4 inches of dense graded crushed stone over 8 inches of gravel borrow.

MATERIALS

Cement concrete shall 5000 psi – ¾” – 705 lbs/cy.

CONSTRUCTION METHODS

Scored Cement Concrete Pavement shall be constructed in accordance with Section 476 of the Standard Specifications and the Massachusetts Department of Transportation Highway Division “Construction Standard Details” (Refer to Drawing No. E 105.2.0 for specific details).

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 486.1 will be measured and paid for at the Contract Unit Price per SQUARE YARD, complete in place. The cost for this work shall include full compensation for, all labor, equipment, materials and any incidentals required to complete work to the satisfaction of the Engineer.

ITEM 490.01 RAILROAD GRADE CROSSING RECONSTRUCTION LUMP SUM

Work under this Item shall include all materials, labor and equipment needed to reconstruct railroad grade crossings, and reconstruct and relocate railroad signal systems as part of the Proposed Silver Line Gateway Project in Chelsea, as indicated on the Plans and as specified herein.

The work under this Item shall conform to the applicable provisions of the MBTA Specifications included in Document A00804 - Appendix B of these Special Provisions.

The Railroad Track and Signals Systems Work consists of improvements to the existing tracks and signal systems at Spruce Street on the East Route (Rockport/Newburyport Commuter Rail Line) to support the construction of the Silver Line busway. The work includes but not limited to, track construction, grade crossing rehabilitation, removal of automatic signal locations, track surfacing & alignment, and the retirement or demolition of existing track and signal system elements.

ITEM 490.01 (Continued)

These improvements will be made while the existing East Route Commuter Rail Line maintains revenue passenger and freight service except for select weekend service shutdowns. The Track and Signals Systems Work shall be done in accordance with the Massachusetts Bay Transportation Authority (MBTA) Standard Specifications attached as Document A00804 - Appendix B.

The work shall also be performed in accordance with the following MBTA Standard Documents:

- The MBTA Railroad Operations Commuter Rail Material Specifications
- The MBTA Railroad Operations Directorate Specifications Guidelines
- The MBTA Commuter Rail Design Standards Manual Volume 1 Section 1 – Track and Roadway
- The MBTA Commuter Rail Book of Standard Plans Track and Roadway Section 1
- The MBTA Commuter Rail Book of Standard Plans Track and Roadway Section 2;
- and the Plans, Special Provisions and Supplemental Specifications herein.

SUBMITTALS

The Contractor shall submit to the Engineer, representative samples, certifications, manufacturer's literature and certified test results for materials to be used under this item. Submit detailed Shop Drawings for the various components of the Trackwork, Grade Crossings and Signal Systems as indicated in Document A00804 - Appendix B.

MATERIALS

Refer to Supplemental Specifications in Document A00804 - Appendix B.

CONSTRUCTION METHODS

Refer to Supplemental Specifications in Document A00804 - Appendix B.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 490.01 – Railroad Grade Crossing Reconstruction. The LUMP SUM price shall include all materials, labor, tools and equipment incidental and necessary for the installation complete in place, of the track work, grade crossing reconstruction, and signal system upgrades including all associated Electrical Work.

ITEM 629.2 PRECAST CONCRETE MEDIAN BARRIER – DOUBLE FACED FOOT

Work under this Item shall conform to the relevant provisions of Section 629 of the Standard Specifications and the following.

The work under this item consists of furnishing and installing Precast Concrete Barriers, complete in place, as indicated on the Contract Documents. The work includes the F-Shape Concrete Barrier with 4-foot fence and the F-Shape Asymmetrical Concrete Barrier with 4-foot Fence.

The 4-foot fence shall conform to the relevant provisions of Section 644.

Concrete barrier transition sections shall conform to the relevant provisions of Section 901.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

F-Shape and F-Shape Asymmetrical Concrete Barriers will be measured and paid for at the Contract Unit Price per FOOT under ITEM 629.2. Said price shall include all labor, material and equipment to furnish and install the barriers, complete in place.

The 4-foot fence will be measured and paid for under Item No. 644.148.

Concrete barrier transition sections will be measured and paid for under Item No. 901.

<u>ITEM 657.</u>	<u>TEMPORARY FENCE</u>	<u>FOOT</u>
<u>ITEM 657.5</u>	<u>TEMPORARY FENCE REMOVED AND RESET</u>	<u>FOOT</u>

The work to be done under these Items shall be in accordance with Sections 644 and 655 of the Standard Specifications and shall consist of furnishing, installing, relocating and final removal of the temporary fence and gates. Location of temporary fence and gates shall be as shown on the plans or as directed by the Engineer. Fence shall be relocated as required during different stages of construction.

The intent of this item is to prevent access to the work area of the new bridge by unauthorized individuals and to protect the safety of personnel and the general public.

The temporary fence shall be a minimum of six (6) feet in height and shall be any type specified in Section 644. All end, corner, gate and intermediate posts shall be driven into the ground and properly supported as outlined in Section 644. Fence post shall not be inserted into the bridge deck. Fence within the bridge shall be installed on top of the temporary concrete barrier. Where temporary chain link fence is required on top of the temporary concrete barriers, the fence posts shall be 2 3/8 inches O.D., galvanized Schedule 40 and 3 feet minimum in height.

The Contractor shall be responsible for maintenance of the temporary fence, and shall be responsible and cognizant that it remains secure and that the area is sealed off to the general public at all times. Fence fabric shall be placed on the face of the post away from the work area. The top edge of the fabric shall be finished with a "knuckled" selvage.

ITEM 657 and ITEM 657.5 (Continued)

During construction it will be necessary to remove and reset the temporary fence at different locations to accommodate the stage construction.

The cost for all end, corner and intermediate brace posts as well as brackets and hardware for attaching fence to concrete barrier and all other incidental materials, labor and equipment required for the installation, including concrete foundations if required, relocation and final removal shall be included under the Contract unit bid price per foot. Material need not be new, but shall not be deteriorated, nor in any way jeopardize the protection purposes intended. All fencing shall meet the approval of the Engineer.

BASIS OF PAYMENT

Payment for ITEM 657. TEMPORARY FENCE shall be at the Contract price per FOOT, complete in place, with twenty (20) percent of the bid price held until the fence is removed. Said price shall include full compensation for all labor, tools, materials and equipment necessary for the installation, maintenance and removal of the fencing. Upon removal all materials shall become the property of the Contractor.

Payment for ITEM 657.5, TEMPORARY FENCE REMOVED AND RESET shall be at the Contract unit price per Foot, complete in place, which price shall include all labor, material and equipment to remove and reset the chain link fence as required for the various stages of construction after the initial installation or as required by the Engineer.

ITEM 657.1**TEMPORARY PEDESTRIAN MGMNT.
GUIDANCE SYSTEM****FOOT**

Work to be done under this item shall consist of installing a system to guide pedestrians around closed sidewalk locations where no current barriers to access exist and that are on the same side of the roadway. Pedestrian Detours that route pedestrians to the opposite side of the street will be paid under Item 851.1 Traffic Cones for Traffic Management.

Elements of the system may include barricade, temporary concrete barrier, temporary concrete barrier with pedestrian rail, temporary curb ramps and associated modifications and appurtenances and signage. The guidance system is to prevent pedestrians from entering the work area, protect pedestrians from vehicles entering a shoulder area temporarily designated for pedestrian use around the work site, and prevent pedestrians from leaving the temporary path and entering the vehicle lane.

Prior to deploying the Temporary Pedestrian Management Guidance System the Contractor shall prepare a sketch plan of the system for the work site showing the barrier system, the width of the path of travel, the locations and types of signs and the locations of temporary pedestrian curb ramps. This will be reviewed and approved by the Engineer prior to its set up. Any material that is damaged during the deployed period and throughout the project shall be replaced at the directions of the Engineer at no additional cost.

ITEM 657.1 (Continued)

Layout must meet the requirements of the ADA and the Massachusetts AAB as well as the rules and regulations for traffic control devices and the 2009 Manual on Uniform Traffic Control Devices (MUTCD). All material which is used adjacent to traffic must meet the requirements of NCHRP350 or MASH. The guidance system must have a continuous bottom rail or edge no more than two (2) inches above the ground to accommodate cane users, have a smooth and continuous top edge no less than 32 inches above the ground to facilitate “hand trailing” and not obstruct or project into the pedestrian path of travel. All elements of the pedestrian guidance system should be nearly vertical and generally within the same plane.

Supplemental information, included with this contract, of some elements of a pedestrian management guidance system should be considered as examples of types of elements which may be used to construct, and not as recommended, required, or the only elements which are acceptable. All pieces bought or constructed by the Contractor, which meet ADA and Massachusetts AAB requirements are acceptable.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 657.1, TEMPORARY PEDESTRIAN MGMNT. GUIDANCE SYSTEM, will be measured by the FOOT of temporary pedestrian route as approved in the sketch plans. The Payment shall be full compensation for providing barriers of various types, signs, temporary curb ramps, associated modifications to the site and all appurtenances. The Contractor must provide sufficient barriers of various types requires for each active construction location. Payment will include the cost of first set up, maintenance throughout the construction, and final removal and completion of the work at the site.

**ITEM 657.11 TEMPORARY PEDESTRIAN MGMNT. GUIDANCE SYSTEM FOOT
REMOVED AND RESET**

Work to be done under this item shall consist of removing and resetting the pedestrian guidance system placed at specific work locations as required by the Engineer.

It is the intent of this item to reuse the placed pedestrian guidance system in many locations. The Contractor shall maintain the integrity of the guidance system throughout the project duration. Special care shall be taken by the Contractor removing and resetting of the guidance system not to damage any piece of the system. The system shall remain in working order throughout the construction. There shall be no compensation made for any damaged section that occurred while performing Item 657.11.

METHOD OF MEASUREMENT

ITEM 657.11, TEMPORARY PEDESTRIAN MGMNT. GUIDANCE SYSTEM REMOVED AND RESET shall be measured per foot completely removed and reset as determined by the Engineer.

ITEM 657.11 (Continued)**BASIS OF PAYMENT**

ITEM 657.11, TEMPORARY PEDESTRIAN MGMNT. GUIDANCE SYSTEM REMOVED AND RESET shall be paid for at the Contract unit price per foot as measured by the Engineer. The price shall include full compensation for removing and resetting the guidance system and placing all materials including work necessary for final completion of the item as specified.

<u>ITEM 660.1</u>	<u>METAL PIPE RAIL REMOVED AND DISCARDED</u>	<u>FOOT</u>
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Work under this Item shall conform to the relevant provisions of Section 665 and shall consist of the removal of the existing iron fence rail, posts, bracing and hardware at the location shown on the plans for offsite disposal.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 660.1, METAL PIPE RAIL REMOVED AND DISCARDED shall be measured per FOOT, measured in its original location.

ITEM 660.1, METAL PIPE RAIL REMOVED AND DISCARDED will be paid for at the Contract Unit Price per FOOT; which price shall include all labor, material and equipment to remove the iron fence, including posts, bracing and hardware, and dispose of it off site.

<u>ITEM 669.1</u>	<u>CHAIN LINK FENCE REMOVED AND DISCARDED</u>	<u>FOOT</u>
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Work under this Item shall conform to the relevant provisions of Section 665 and shall consist of the removal of the existing chain link fence, posts, bracing and hardware at the locations shown on the plans for offsite disposal.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 669.1, CHAIN LINK FENCE REMOVED AND DISCARDED shall be measured per FOOT, measured in its original location.

ITEM 669.1, CHAIN LINK FENCE REMOVED AND DISCARDED will be paid for at the Contract Unit Price per FOOT; which price shall include all labor, material and equipment to remove the chain link fence, including posts, bracing and hardware, and dispose of it off site.

ITEM 697.1**SILT SACK****EACH**

Work under this item shall conform to the relevant provisions of Sections 227 and 670 of the Standard Specifications and the following:

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in retained existing and proposed catch basins and drop inlets within the project limits and as required by the Resident Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Department.

When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as specified in Section 227 of the Standard Specifications

COMPENSATION

Silt sacks will be measured and paid at the Contract unit price per each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 703.**HOT MIX ASPHALT DRIVEWAY****TON**

The work under this Item shall conform to the relevant provisions of Section 701 and Section 455 Superpave HMA Specifications of Document 00717 and to the following:

The surface course shall be a compacted thickness of 1 1/2 inches Superpave Surface Course - 9.5 (SSC-9.5). The intermediate course shall be a compacted thickness of 2 inches Superpave Intermediate Course - 12.5 (SIC-12.5).

All Superpave HMA mixtures under this item shall be either 50 or 65 gyration mixtures. This item shall not be subject to the Quality Assurance requirements of Section 450 Hot Mix Asphalt Pavement.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 703 will be measured and paid as per Subsections 701.80 and 701.81

ITEM 740. ENGINEER'S FIELD OFFICE AND EQUIPMENT-TYPE A MONTH

Work under this Item shall conform to the relevant provisions of Section 740 of the Standard Specifications. The field office/trailer shall be equipped according to Subsection 740.41 of the Standard Specifications and the following.

Provide one (1) office space, within an existing building located in or within 0.5 miles of the Project site, in a location and space to be accepted by the MassDOT. Office space shall be fully equipped and ready for occupancy by MassDOT, 30 days prior to the commencement of any construction work on the project. consist of providing two independent maintained field offices facilities for MassDOT and the MBTA. The work shall conform to the relevant provisions of Section 740 of the Standard Specifications and the following:

MASSDOT FIELD OFFICE:

Four (4) networked computer systems, four networked lap tops and four a digital cameras, one camcorder (refer to Volume II, Section 10.24) meeting the requirements set forth below including installation, maintenance, power, paper, disks and other supplies shall be provided at the Resident Engineer's Office:

All equipment shall be UL approved and Energy Star compliant.

The networked computer systems shall meet the following minimum criteria or better:

System Features

OS: Windows® 7 Professional x64
Processor: i5 Processor (or higher)

Memory

RAM: 8 GB 1600 MHz DDR3 SDRAM (2x4GB modules)

Storage

Internal drive: 500GB, 7200RPM SATA
DVD-RW/CD-RW: Combo drive including DVD ± RW
Network Adapter: Gigabit Ethernet (GbE)

Graphics

Graphics: HD Graphics 2500 (or higher)

Expansion features

USB Ports: 4 USB 3.0, 6 USB 2.0 ports
1 serial, 2 PS/2, 1 VGA, 1 Display Port, 1 audio in, 1 audio out, 1 RJ-45,
1 headphone, 1 microphone
Mouse: Optical (laser) mouse with scroll, mouse pad included
Monitor: 24" LED LCD
Speakers: Desktop

ITEM 740. (Continued)

Applications: MS Office 2010 Professional plus one upgrade with all security updates
Latest Adobe Acrobat Professional with all security updates
Antivirus software with all current security updates maintained through the life of the contract.
Scheduling software (refer to Volume II, Section 9.1.3.2)

Web Browser: Latest Internet Explorer with all security updates
Internet access: High speed internet access

The lap top computer systems shall consist of the following or better:

System Feature

Operating system: Windows® 7 Professional 64
Processor: i5 Processor (or higher)

Memory

Standard Memory: 6 GB 1333 MHz DDR3 SDRAM
Memory slots: (1DIMM) (2 slots)

Storage

Internal drive: 160 GB (Solid State Drive Flash Module)
Monitor: 17" High-definition LED

DVD-RW/CD-RW: Recordable DVD/CD drive (DVD± R DL; DVD± RW; CD± RW)

Network Adapter: Built-in 10/100/1000 Ethernet LAN (RJ-45 connector)

Wireless Networking Wireless-B+ G+ N

USB Ports: 4 high-speed USB ports

Mouse: Optical mouse with scroll

Laptop carrying case

Laptop car charger

Battery: Li-Ion Battery

OS: Windows 7 with all current security updates

Web Browser: Internet Explorer with all current security updates

Applications: MS 2010 Office Professional plus one upgrade with all security updates

Latest Adobe Acrobat Professional with all security updates

Antivirus software with all current security updates maintained through the life of the contract.

Other Interfaces: Smart Card Reader, Bluetooth 2.1

The Multifunction Printer System shall meet the following minimum criteria or better:

Color laser printer, fax, scanner, email and copier all in one with the following minimum capabilities:

ITEM 740. (Continued)

- Estimated volume 8,000 pages per month - 600 x 600 dpi capability
- LCD touch panel display - 30 pages per minute print speed (color),
- 50 page reversing automatic document feeder - 4 Paper Trays Standard (RADF) (not including the bypass tray)
- Reduction/enlargement capability - Automatic duplexing
- Ability to copy and print 11" x 17" paper size - Finisher with staple functions
- email and network pc connectivity - Standard Ethernet. Print Controller
- Microsoft and Apple compatability - Scan documents to PDF, PC and USB
- ability to overwrite latent images on hard drive - ability to print with authenticated access

Protection

Contractor must supply a maintenance contract for next day service, and all supplies (toner, staples, paper) necessary to meet estimated monthly usage.

The Digital Cameras shall meet the following minimum criteria or better:

- Resolution: 14 Megapixel
- Optical Zoom: 5x
- Waterproof: to a depth of 33ft (10m)
- Shockproof: up to 6.6ft (2m)
- Freezeproof: 14°F (-10°C)
- Memory: 8 GB SD Card
- USB Port: USB 2.0 with PC cable
- Screen: 2.7+ inch LCD with scratch-resistance and anti-reflectance
- Battery Power: 2 rechargeable batteries and a battery charger
- Carrying Case: Rain-proof with shoulder strap

In addition to the computers specified above, the following items shall also be provided at the engineer's field office.

- (100) compact disks (CD to remain the property of the Department)
- (50) rewritable compact disks (CDRW to remain the property of the Department)
- (20) rewritable compact disks (DVD to remain the property of the Department)
- (24) 8 GB USB flash drives (to remain the property of the Department)
- One 36" Plotter (up to 2400X 1200 optimized from 1200X1200 input DPI with maximum detail selected (color and black resolution)
- 24" x 36" copier machine (up to 2400 x1200 optimized from 1200 x 1200 input DPI with maximum detailed selected (color and black resolution) with scanning capabilities. Copiers to be networked with office computers.
- One overhead projector and portable screen.

ITEM 740. (Continued)

Table Computers for Document Control Support

The Contractor shall provide and maintain six (6) tablet computers for MassDOT construction staff to use from the NTP of the Contract to the completion of the Contract. It will be the responsibility of the Contractor to provide updates and maintenance as needed. The purpose of those tablet computers will be to have remote or direct access to all construction drawings and documents (final, early start of construction, shop, and working). It will be the responsibility of the Contractor to maintain the tablet computers, and ensure that the latest information is contained within the memory of the tablet computer.

The tablet computer will be a touch-screen device with a minimum diagonal screen dimension of 9.7", and a minimum of 64 gigabytes of memory. The tablet computer will include a minimum of a 1 gigahertz dual-core processor, and include gyroscope, accelerometer, and ambient light sensor. The tablets should be equipped with internet connection (Wi-Fi and 4G LTE), all applicable software applications, and a mobile data plan (4G LTE connection or higher with unlimited monthly data) with a capability to allow connection to the Project documents with and without the presence of a Wi-Fi connection. The tablets should be capable of taking digital photographs and videos at a resolution comparable with a standard digital camera. Upon completion of the Project, the tablet computers will become the property of the Contractor

The Engineer's Field Office shall be a minimum of 2500 square feet in size and include one conference room table with (12) office chairs.

All equipment shall be maintained for the life of the Contract.

Scheduling Software Licenses shall be transferred to MassDOT at the completion of the Project. Disks, flash drives, and card readers with cards shall become the property of the Department. All other equipment provided shall become the property of the Contractor upon final acceptance. The Engineer's Field Office and the equipment included herein including the computer systems, printer, camcorder and cameras shall remain the property of the Contractor at the completion of the project.

ITEM 745.01**BUS RAPID TRANSIT STATIONS****LUMP SUM**

Work under this Item shall include all materials, labor and equipment needed to construct the Massachusetts Bay Transportation Authority (MBTA) Bus Rapid Transit Stations along the Proposed Silver Line Gateway in Chelsea, as indicated on the Plans and as specified herein.

The work under this Item shall conform to the applicable provisions of the MBTA Specifications included in Document A00803 - Appendix A of these Special Provisions.

The Bus Rapid Transit (BRT) Stations shall include, but not be limited to, the following items: concrete platforms & curbs, tactile surface pavers, canopies and foundations, passenger shelters, communications systems including variable message signs (VMS), police call boxes, public address systems, conduit, cabling and communication shelter, closed circuit televisions system, station lighting, station signage, and fare collection system.

The BRT Stations will be constructed in accordance with the applicable requirements of the MBTA, as indicated in the Specifications contained in Document A00804 - Appendix B, including full installation of the BRT Stations at Mystic Mall, Box District and Eastern Avenue. Portions of the Downtown Center BRT Station, between Arlington Street and Washington Avenue, will not be installed at this time. The Contractor is directed to provide certain materials and equipment for this station and deliver to an MBTA facility for installation by others at a future date.

SUBMITTALS

The Contractor shall submit to the Engineer, representative samples, certifications, manufacturer's literature and certified test results for materials to be used under this item. Submit detailed Shop Drawings for the various components of the BRT Stations as indicated in Document A00803 - Appendix A.

MATERIALS

Refer to Supplemental Specifications in Document A00803 - Appendix A.

CONSTRUCTION METHODS

Refer to Supplemental Specifications in Document A00803 - Appendix A.

ITEMS 745.01 (Continued)**METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 745.01 – Bus Rapid Transit Stations. The LUMP SUM price shall include all materials, labor, tools and equipment incidental and necessary for the installation, complete in place, of the four (4) BRT Stations. The LUMP SUM price shall also include providing including providing certain materials and equipment for the Downtown Chelsea BRT station and delivering to an MBTA facility, as directed.

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of unit prices for the major components of the BRT Stations as listed below. The BRT Station LUMP SUM breakdown quantities provided below are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the Lump Sum contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual Station components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 745.01 and no further compensation will be allowed.

<u>Sub-Item Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
Concrete Foundations and Platforms	1	LS		
Structures	1	LS		
Metal Railings	180	FT		
Painting	1	LS		
Station Signage	1	LS		
Modular Tactile Surfaces	650	FT		
Fare Collection Equipment Installation	1	LS		
Station Lighting System	1	LS		
Communications System	1	LS		
Passenger Assistance System	1	LS		
Closed Circuit Television System	1	LS		
Variable Message Signs	1	LS		

Total Cost of Item 745.01 =

The above schedule applies only to the MBTA Bus Rapid Transit Stations. Payment for similar materials and construction at locations other than at these structures shall not be included under this Item.

ITEM 745.02**MBTA INSPECTOR'S BOOTH****LUMP SUM**

Work under this Item shall include all materials, labor and equipment needed to construct the Massachusetts Bay Transportation Authority (MBTA) Inspector's Booth for the Proposed Silver Line Gateway in Chelsea, as indicated on the Plans and as specified herein.

The work under this Item shall conform to Section 13126 and applicable provisions of the MBTA Supplemental Specifications included in Document A00803 - Appendix A of these Special Provisions.

The MBTA Inspector's Booth shall be a minimum of eight feet (8') long; and four feet (4') wide and include doors, hardware, finishes, electrical systems, and HVAC systems, and security systems.

SUBMITTALS

Submit detailed Shop Drawings for the MBTA Inspector's Booth as indicated in Document A00803 - Appendix A.

MATERIALS

Refer to Section 13126 of the MBTA Supplemental Specifications in Document A00803 - Appendix A.

CONSTRUCTION METHODS

Refer to Section 13126 of the MBTA Supplemental Specifications in Document A00803 - Appendix A.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 745.02 – MBTA Inspector's Booth.

The LUMP SUM price shall include all materials, labor, tools and equipment incidental and necessary for the installation complete in place, including associated Mechanical Work, Electrical Work and Security Systems.

ITEM 746.01**MBTA TEMPORARY COMFORT STATION****LUMP SUM**

Work under this Item shall include all materials, labor and equipment needed to construct the Massachusetts Bay Transportation Authority (MBTA) Temporary Comfort Station for the Proposed Silver Line Gateway in Chelsea, as indicated on the Plans and as specified herein.

The work under this Item shall conform to Section 13127 and applicable provisions of the MBTA Supplemental Specifications included in Document A00803 - Appendix A of these Special Provisions.

The Temporary Comfort Station consists of a portable facility providing separate men's and women's toilets and wash room facilities. The Temporary Comfort Station shall be a minimum of sixteen feet (16') long; and twelve feet (12') wide.

SUBMITTALS

Submit detailed Shop Drawings for the temporary comfort facility as indicated in Document A00803 - Appendix A.

MATERIALS

Refer to Section 13127 of the MBTA Supplemental Specifications in Document A00803 - Appendix A.

CONSTRUCTION METHODS

Refer to Section 13127 of the MBTA Supplemental Specifications in Document A00803 - Appendix A.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 746.01 – MBTA Temporary Comfort Station.

The LUMP SUM price shall include all materials, labor, tools and equipment incidental and necessary for the installation complete in place, including associated Plumbing, Mechanical and Electrical Work.

ITEM 756. NPDES STORM WATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit (CGP) issued by the U.S. Environmental Protection Agency (EPA).

Pursuant to the Federal Clean Water Act, construction activities which disturb one acre or more are required to apply to the EPA for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. On February 16, 2012 (77 FR 12286), EPA issued the final NPDES Construction General Permit (CGP) for construction activity. The Contractor shall be fully responsible for compliance with the CGP. Should a fine or penalty be assessed against it, or MassDOT, as a result of a local, state, or federal enforcement action due to non-compliance with the CGP, the Contractor shall take full responsibility.

The NPDES CGP requires the submission of a Notice of Intent (NOI) to the EPA prior to the start of construction (defined as any activity which disturbs land, including clearing and grubbing). There is a 14 day review period commencing from the date on which EPA enters the Notice into their database. The Contractor is advised that, based on the review of the NOI, EPA may require additional information, including but not limited to, the submission of the Storm Water Pollution Prevention Plan (SWPPP) for review. Work may not commence on the project until final authorization has been granted by EPA. Any additional time required by EPA for review of submittals will not constitute a basis for claim of delay.

In addition, if the project discharges to an Outstanding Resource Water, vernal pool, or is within a coastal ACEC as identified by the Massachusetts Department of Environmental Protection (DEP), a separate notification to DEP is required. DEP may also require submission of the Storm Water Pollution Prevention Plan for review and approval. Filing fees associated with the notification to DEP and, if required, the SWPPP filing to DEP shall be paid by the Contractor.

The CGP also requires the preparation and implementation of a SWPPP in accordance with the afore-mentioned statutes and regulations. The Plan will include the CGP conditions and detailed descriptions of controls of erosion and sedimentation to be implemented during construction. It is the responsibility of the Contractor to prepare the SWPPP to meet the requirements of the most recently issued CGP. The Contractor shall submit the Plan to the Engineer for approval at least 4 weeks prior to any site activities. It is the responsibility of the Contractor to comply with the CGP conditions and the conditions of any state Wetlands Protection Act Order, Water Quality Certification, Corps of Engineers Section 404 Permit and other environmental permits applicable to the project and to include in the SWPPP the methods and means necessary to comply with applicable conditions of said permits (reference to Part 9.1.1 of the 2012 CGP).

It is the responsibility of the Contractor to complete the SWPPP in accordance with the EPA CGP, provide all information required, and obtain any and all certifications as required by the CGP. Any amendments to the SWPPP required by site conditions, schedule changes, revised work, construction methodologies, and the like are the responsibility of the Contractor. Amendments will require the approval of the Engineer prior to implementation.

ITEM 756. (Continued)

Included in the CGP conditions is the requirement for inspection of all erosion controls and site conditions on a weekly basis as well as after each incidence of rainfall exceeding 0.25 inches in twenty-four hours. For multi-day storms, EPA requires that an inspection must be performed during or after the first day of the event and after the end of the event. The CGP requires that inspections be performed by a qualified individual. MassDOT requires proof of completion of a 4 hour minimum sedimentation and erosion control training class current to the latest CGP. This individual can be, but not limited to, someone that is either a certified inspector, certified professional, or certified storm water inspector. The documentation shall be included as an appendix in the SWPPP. The Engineer must approve the contractor's inspector. This individual shall be on-site during construction to perform these inspections. In addition, if the Engineer determines at any time that the inspector's performance is inadequate, the Contractor shall provide an alternate inspector. Written weekly inspection forms, storm event inspection forms, and Monthly Summary Reports must be completed and provided to the Engineer. Monthly Summary Reports must include a summary of construction activities undertaken during the reporting period, general site conditions, erosion control maintenance and corrective actions taken, the anticipated schedule of construction activities for the next reporting period, any SWPPP amendments, and representative photographs.

The Contractor is responsible for preparation of the Plan, all SWPPP certifications, inspections, reports and any and all corrective actions necessary to comply with the provisions of the CGP. Work associated with performance of inspections is not included under this Item. The Standard Specifications require adequate erosion control for the duration of the Contract. All Control measures must be properly selected, installed, and maintained in accordance with manufacturer specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or is no longer adequate, it is the responsibility of the Contractor to replace or modify the control for site conditions at no additional cost to the Department. The Contractor must maintain all control measures and other protective measures in effective operating condition and shall consider replacement of erosion controls for each construction season.

This Item addresses acceptable completion of the SWPPP, any revisions/amendments required during construction, and preparation of monthly reports. In addition, any erosion controls beyond those specified in bid items elsewhere in this contract which are selected by the Contractor to facilitate and/or address the Contractor's schedule, methods and prosecution of the work shall be considered incidental to this item.

The Contractor is advised The CGP provides specific requirements for temporary and final stabilization. This shall be incorporated into the project schedule. The permit defines specific deadline requirements for Initial Stabilization ("immediately", i.e., no later than the end of the next work day following the day when earth-disturbing activities have temporarily or permanently ceased) and for Complete Stabilization Activities (no later than 14 calendar days after the initiation of stabilization). Stabilization criteria for vegetative and non-vegetative measures are provided in the CGP.

ITEM 756. (Continued)

The CGP requires the submission of a Notice of Termination (NOT) from all operators when final stabilization has been achieved, as well as removal and proper disposal of all construction materials, waste and waste handling devices, removal of all equipment and construction vehicles, removal of all temporary stormwater controls, etcetera. Approval of final stabilization by the Engineer and confirmation of submission of the NOT will be required prior to submission of the Resident Engineer's Final Estimate. The permittee is required to use EPA's electronic NOI system or "eNOI system" to prepare and submit NOT. The electronic NOT form can be found at www.epa.gov/npdes/stormwater/cgpenoi. If you are given approval by the EPA Regional Office to use a paper NOT, you must complete the form in Appendix K of the 2012 CGP.

COMPENSATION

Payment for all work under this Item shall be made at the contract unit price, lump sum, which shall include all work detailed above, including plan preparation, required revisions, revisions/addenda during construction, monthly reports and filing fees.

Payment of 50% of the contract price shall be made upon acceptance of the Storm Water Pollution Prevention plan. Payment of 40% of the contract price shall be made in equal installments for implementation of the Stormwater Pollution Prevention plan. Payment of the final 10% of the contract price shall be paid upon satisfactory submissions of a Notice of Termination (NOT) when final stabilization has been achieved.

ITEM 756.1
ITEM 756.3**STORM WATER DETENTION AREA**
STORM WATER INFILTRATION SYSTEM**LUMP SUM**
LUMP SUM

Work under these items shall include all materials, labor and equipment needed to construct the storm water detention area and the storm water infiltration system as part of the Proposed Silver Line Gateway Project in Chelsea, as indicated on the Plans and as specified herein.

The storm water detention area is located at approximately Station 81+00 and includes construction of a storm water detention area to replace the existing storm water basin located at approximately Station 82+00. The new detention area shall be constructed before the existing basin is filled. The work shall conform to the applicable provisions of Sections 120, 201, 220, 230, 258 and 270.

The storm water infiltration system is located from Station 59+00 to Station 76+00 and includes construction of the swale as indicated on the Plans. The work shall conform to the applicable provisions of Sections 120, 140, 150, 200, 751, 760, 767, 771 and these Special Provisions.

SUBMITTALS

Shop drawings shall be submitted for review and approval, indicating the detention area and the infiltration system proposed and including layout of the systems, details of the inlets and outlets of the system.

METHOD OF MEASUREMENT

Separate measurement and payment will not be made for work under these items, but all costs in connection therefore, including all, excavation, backfilling, installation, transportation, labor, filter fabric, crushed stone, backfill materials, pipe, drainage structures, tools, equipment, accessories and incidentals necessary to complete the work will be included in the Contract LUMP SUM price for ITEM NO. 756.1 – STORM WATER DETENTION AREA, and ITEM NO. 765.3 – STORM WATER INFILTRATION SYSTEM.

BASIS OF PAYMENT

Payment for ITEM 756.1, STORM WATER DETENTION AREA and ITEM 756.3, STORM WATER INFILTRATION SYSTEM will be made at the respective Contract LUMP SUM prices for the quantities determined as specified above.

ITEM 765.11 **TEMPORARY AND PERMANENT SEEDING** **SQUARE YARD****DESCRIPTION**

The intent of this item is to provide both a temporary cover crop for the prevention of erosion and to provide a permanent grassed surface. Unless otherwise shown on the plans or directed by the Engineer, all exposed soil areas will be provided with a grassed surface.

GENERAL

Work under this item shall include furnishing and installing grass seed mix as shown on the contract drawings, and in this special provision. Work under this item shall conform to the relevant provisions of Division II, Section 765, Section 767, Division III, Section M6, and the following:

EXAMINATION OF LOCATION

The Contractor must satisfy himself by his own investigation and research, regarding all conditions affecting the work and the amount of work to be done, the labor and equipment needed, and make his bid in sole reliance thereon.

MATERIALS**Submittals**

Thirty days prior to the time of seeding, the Contractor shall provide for the approval by the Engineer a written description for the grass seed mix showing the percentage by weight of each of the kinds of seed. This description shall also include the following:

- a. Name and location of the seed supplier.
- b. Origin and date of harvest of each of the various kinds of seed.
- c. A statement of the purity and germination of the seeds.
- d. The estimated number of seeds per pound of each of the kinds of seed to be furnished.

Limestone shall conform to the requirements of Division III Subsection M6.01.0, except that limestone shall be pelletized dolomitic limestone. Limestone shall be applied as specified in Subsection 765.61 to achieve a soil pH range of 6.0 to 7.0.

Fertilizer shall conform to the requirements of Division III Subsection M6.02.0, with the following amendments.

Nutrient analysis shall be as follows:

Nitrogen	10%
Phosphorous	20%
Potassium	10%

ITEM 765.11 (Continued)

Nitrogen shall be in slow release form. At least 50% by weight of the nitrogen shall be derived from organic materials. Fertilizer shall be applied at a rate of 1.5 oz. per square yard (450 lb./acre).

If seeding is to be done hydraulically, the hydroseed mixture shall contain a green dye to allow for easy visual metering during application. Mixture shall be nontoxic to plant life or animal life.

If seeding is to be broadcast, sand to be mixed with seed shall conform to Division III Material Specification M4.02.02.

Water, including hose and all other watering equipment required for the work, shall be furnished by the Contractor to the site at no extra cost. Water shall be suitable for irrigation and free from ingredients harmful to plant life. All work damaged due to lack of water, or too much water, shall be the Contractor's responsibility to correct.

Mulch shall be straw mulch as specified in Materials Section M6.04.2. Mulch shall be air-dried, threshed, small grain straw of oats, wheat, barley or rye. Mulch shall be free of undesirable weed seed.

The following is a list of seed types to be used in this project, and modifies Material Specification M6.03.0. Seed shall be a fresh, clean, new crop seed. Grass shall be of the previous year's crop and the weed seed content shall not exceed 1% by weight. The seed shall be furnished and delivered, in the proportion specified, in new, clean, sealed, and properly labeled containers. All seed shall comply with State and Federal seed laws. Seed shall be endophyte enhanced where applicable. Contractor shall submit manufacturer's Certificates of Compliance. Seed which has become wet, moldy or otherwise damaged shall not be acceptable.

Permanent grass seed mixture for slopes and general purpose areas shall be proportioned by weight as follows:

	Proportion	Min. Purity.	Min. Germination
Creeping Red Fescue	40%	97%	80%
Reliant Hard Fescue	30%	96%	85%
Little Bluestem	15%	55%	60%
Switchgrass	10%	60%	60%
Red Top	5%	92%	90%

Permanent grass seed mixture for lawn areas shall be proportioned by weight as follows:

	Proportion	Min. Purity.	Min. Germination
Creeping Red Fescue	40%	97%	80%
Kentucky Bluegrass	30%	85%	80%
Reliant Hard Fescue	30%	96%	85%
Red Top	5%	92%	90%

ITEM 765.11 (Continued)

Permanent grass seed for slope, general purpose, and lawn areas shall be planted at a rate of 90 lb of seed per acre.

Temporary erosion control seed mixture to be used shall depend on season. For spring and summer seeding from April 1 through September 1, mix shall be the following, in proportion by weight:

	Proportion	Min. Purity.	Min. Germination
Annual Rye	75%	98%	90%
Palmer II Perennial Rye	25%	98%	90%

Spring and summer seed for erosion control shall be planted at a rate of 30 lb/acre.

For fall seeding from September 1 through December 1, temporary erosion control mix shall be the following, in proportion by weight:

	Proportion	Min. Purity.	Min. Germination
Winter Rye	80%	97%	85%
Palmer II Perennial Rye	20%	98%	90%

Fall seed for erosion control shall be planted at a rate of 75 lb/acre.

For the period December 1 through April 1, see below for protection of newly loamed and graded areas.

Tackifier shall be a non-petroleum based emulsion.

CONSTRUCTION METHODS**General**

For all seeded areas the Contractor will notify the Engineer and arrange for inspections at the following times:

- A. Before seeding, after loam has been spread and amendments have been incorporated.
- B. During seeding operations
- C. Upon completion of hand seeding/hydroseeding operations to establish the Maintenance Period.
- D. End of Maintenance Period to determine Acceptance of Work

ITEM 765.11 (Continued)**Surface Preparation of Soils**

The Contractor shall take all necessary measures to ensure that areas to be seeded are kept dry during preparation, seeding, and establishment of seed.

Bare soils shall be raked to remove large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. All depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be re-graded and rolled until presenting a smooth and even finish corresponding to the required grades.

Seeding

Permanent grass mix and temporary erosion control mix shall be planted at the same time.

Seeding shall be done within ten days following soil preparation in order to insure optimum seed-to-soil contact. If construction is to be interrupted or stopped between construction seasons, no excavated or graded or stockpiled soils shall be unprotected. Temporary seeding will be done early enough for establishment to provide adequate protection during winter.

Seed shall be planted, limed, and fertilized according to provisions of Item 765. Seeding rates shall be as described above in Materials.

Seeding and mulching shall be separate operations, with mulching following seeding.

If seeding is to be done hydraulically, the spray equipment shall be so designed that when the mixture is sprayed over an area, the mixture of limestone, fertilizer, and grass seed shall be equal in quantity to the specified rates. Prior to the start of work, the Contractor shall furnish the Engineer with a certified statement as to the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the Contractor's hydroseeder. Upon completion of seeding operations, the Contractor shall furnish the Engineer with a certified statement on the actual quantity of solution applied.

If seeding is to be accomplished by dry broadcasting, mix the seeds with two parts by volume clean washed sand to facilitate uniform broadcasting of the seed. Contractor shall furnish the Engineer with a certified statement as to the number of pounds of limestone, fertilizer and grass seed used.

Following seeding, place straw mulch according to Division II Section 767.62. Straw mulch shall be placed evenly and uniformly over the site at a rate of one ton per acre. Straw cover should provide an even cover with sufficient openings to allow germination of grass. Tack down mulch using tackifier at rates recommended by the manufacturer. Mulch and tackifier may be applied together as a mix or separately.

ITEM 765.11 (Continued)

When protection of newly loamed and graded areas is necessary at a time which is outside of the seeding season, the Contractor shall protect those areas by whatever means necessary, such as straw applied with a tackifier, or by other measures approved by the Engineer. Contractor shall be responsible for prevention of siltation in the areas beyond the limit of work.

The Engineer's decision shall prevail in the event a dispute develops with the Contractor as to whether or not the seeded areas have developed into a satisfactory stand. To be acceptable, a stand of grass shall consist of a uniform stand of at least 75 percent established permanent grass species, with a minimum uniform count of 150 plants per square foot.

COMPENSATION

Measurement for seeding shall be by the square yard. Payment for work under this item shall be at the contract unit price for Item 765.11, which price shall be full compensation for equipment, labor, materials, and incidentals necessary to complete this work.

ITEM 767.12**COMPOST FILTER TUBES****FOOT**

The purpose of this item is to provide a linear, compost-filled tube for filtering suspended sediments from storm water flow. This item shall conform to the requirements of Section 751 and 767 of the Standard Specifications and the following.

MATERIALS

Material for the filter tubes shall be compost meeting M1.06.0, except that no manure or bio-solids shall be used. In addition, no kiln-dried wood or construction debris shall be allowed. Particle size analysis: 98% shall pass through a 3 inch (75mm) sieve; 30-50% shall pass 3/8 inches (10mm) sieve.

Tubes for compost filters shall be a minimum of 12 inches (300 mm), a maximum of 18" (450mm) in diameter. Tube material shall be a knitted mesh with 1/8" - 3/8" (3-10 mm) openings, and made of biodegradable (cotton or jute) materials. **Photodegradable fabric may be used; however, photodegradable fabric must be removed and disposed of by the contractor, at his expense, at the end of the contract.** Additional tubes shall be used at the direction of the Engineer.

As shown in the detail, the 1 foot (0.2 meters) wide by 2 inch (50 mm) deep wedge of compost spread along the top of the filter tube shall be incidental to this item.

Stakes for anchors, if required, shall be nominal 2 x 2 stakes.

METHODS

Tubes of compost may be filled on site or shipped. Tubes shall be placed, filled and staked in place as required to ensure stability against water flows. All tubes shall be tamped to ensure good contact with soil.

ITEM 767.12 (Continued)

The Contractor shall ensure that the filter tubes function as intended at all times. Tubes shall be inspected after each rainfall and at least daily during prolonged rainfall. The Contractor shall immediately correct all deficiencies, including, but not limited, to washout, overtopping, clogging due to sediment, and erosion. The contractor shall review location of tubes in areas where construction activity causes drainage runoff to ensure that the tubes are properly located for effectiveness. Where deficiencies exist, such as overtopping or wash-out, additional staking or compost material shall be installed as directed by the Engineer. Contractor shall remove sediment deposits as necessary to maintain the filters in working condition. The functional integrity of filter tubes shall be maintained in sound condition at all times. Filter tubes that are decomposing, cut, or otherwise compromised shall be repaired or replaced as directed by the Engineer and be incidental to this item.

Filter tube fabric and stakes shall be removed by the Contractor when site conditions are sufficiently stable to prevent surface erosion, and after receiving permission to do so from the Engineer. All biodegradable tube fabric shall be cut and laid flat in place to decompose on-site at the direction of the Engineer. Tube fabric that is not decomposing satisfactorily shall be removed and disposed off-site by the Contractor. At the direction of the Engineer, the Contractor may rake out and seed compost so that it is no greater than 2 inches (50 mm) in depth on soil substrate.

COMPENSATION

Measurement for this Item shall be by the FOOT of Compost Filter Tube installed, approved, and maintained in place. Payment shall be per FOOT which price shall be compensation for all labor, equipment and materials necessary to complete the work specified above, including, but not limited to, stakes and tube fabric, compost mulch wedge along top of tubes, removal and disposal of fabric and stakes, raking and seeding of compost.

<u>ITEM 772.339</u>	<u>CEDAR- RED ‘EMERALD SENTINEL’ 7-8 FT.</u>	<u>EA</u>
<u>ITEM 773.412</u>	<u>PINE-WHITE ‘FASTIGIATE’ 8-10 FT.</u>	<u>EA</u>
<u>ITEM 775.450</u>	<u>LOCUST-HONEY ‘HALKA’ 2-2.5 IN. CALIPER</u>	<u>EA</u>
<u>ITEM 776.543</u>	<u>MAPLE-RED-‘OCTOBER GLORY’ 2-2.5 IN. CALIPER</u>	<u>EA</u>
<u>ITEM 777.542</u>	<u>PLANETREE-LONDON 2 –2.5 IN. CALIPER.</u>	<u>EA</u>
<u>ITEM 778.161</u>	<u>BIRCH- RIVER ‘HERITAGE’ 8-10 FOOT CLUMP</u>	<u>EA</u>
<u>ITEM 778.387</u>	<u>CHERRY-SARGENT COLUMNAR 2.5-3 IN CALIPER</u>	<u>EA</u>
<u>ITEM 785.631</u>	<u>INKBERRY 18-24 INCH</u>	<u>EA</u>
<u>ITEM 786.114</u>	<u>CREeping JUNIPER- “BLUE CHIP” 18-24 IN.</u>	<u>EA</u>
<u>ITEM 789.333</u>	<u>BAYBERRY SHRUB- NORTHERN 2-3 FT.</u>	<u>EA</u>
<u>ITEM 790.635</u>	<u>CORNUS SERICEA ‘KELSYII’ 18-24 IN.</u>	<u>EA</u>
<u>ITEM 791.033</u>	<u>ELDERBERRY 2-3 FT.</u>	<u>EA</u>
<u>ITEM 793.043</u>	<u>NINEBARK SHRUB-“SUMMER WINE” 2-3 FT.</u>	<u>EA</u>
<u>ITEM 794.321</u>	<u>SUMAC SHRUB – FRAGRANT 15-18 IN.</u>	<u>EA</u>
<u>ITEM 794.731</u>	<u>SUMMERSWEET SHRUB 18-24 IN.</u>	<u>EA</u>
<u>ITEM 794.803</u>	<u>SWEETFERN 1 GAL.</u>	<u>EA</u>
<u>ITEM 795.079</u>	<u>VIBURNUM –WITHEROD 18-24 IN.</u>	<u>EA</u>
<u>ITEM 795.081</u>	<u>VIBURNUM –WITHEROD 24-30 IN.</u>	<u>EA</u>
<u>ITEM 796.100</u>	<u>NEPETA –“WALKERS LOW” 1 GAL.</u>	<u>EA</u>
<u>ITEM 796.455</u>	<u>SWITCH GRASS 2 GAL.</u>	<u>EA</u>
<u>ITEM 796.715</u>	<u>BLACK-EYED SUSAN 2 QUART</u>	<u>EA</u>
<u>ITEM 796.725</u>	<u>CARDINAL FLOWER 2 QUART</u>	<u>EA</u>
<u>ITEM 796.768</u>	<u>DAYLILY – “RED HOT RETURNS” 1 GAL.</u>	<u>EA</u>
<u>ITEM 796.803</u>	<u>NEW ENGLAND ASTER 1 GAL.</u>	<u>EA</u>
<u>ITEM 796.817</u>	<u>PURPLE CONEFLOWER 2 QUART</u>	<u>EA</u>
<u>ITEM 796.900</u>	<u>BUTTERFLY MILKWEED 2 QUART</u>	<u>EA</u>
<u>ITEM 796.950</u>	<u>GOLDENROD 1 GAL.</u>	<u>EA</u>

The work under this item shall include the furnishing and installing of Landscape Plantings and shall conform to the applicable requirements of Section 771, PLANTING TREES, SHRUBS AND GROUND COVER, of the June 18, 2010 Standard Special Provisions.

Submittals

Samples: Submit samples of:

1. Mulch: Submit one cubic foot sample and manufacturer/supplier’s name.

Plant List:

1. Within 30 days of receipt of Contract, submit plant list for review by Architect/ Owner’s Representative which includes:
 - a. plant materials proposed for project and corresponding nursery source where plants are to be selected.

ITEMS 772.339 thru 796.950. (Continued)

- b. written documentation indicating nursery(s) have available the plants in the species, quantity and size(s) shown on Drawings.
 - c. for plants indicating names of plants in accordance with American Joint Committee on Horticultural Nomenclature.
2. Schedule for review at nursery source by Architect/ Owner's Representative with Contractor present.
3. Substitutions: plant list shall indicate unavailable materials and document a thorough search for materials. For unavailable materials list sources contacted with telephone number, date and person's name at source.

Schedules

1. Submit planting schedule for approval.

Quality Assurance

Planting shall be performed by a certified landscape contractor with a minimum of five years planting work experience and under full time supervision of a qualified supervisor.

Selection and Inspection of Plants

Plants shall be selected by Architect/ Owner's Representative at place of growth for conformity to specification requirements as to quality, size and variety. Such approval shall not impair right of inspection and rejection upon delivery at site or during progress of work. Cost of replacement shall be borne by Contractor.

Source Limitations:

1. Plants shall have been grown under climatic conditions similar to those in the locality of the project for at least the previous two years. Unless approved by the Landscape Architect, plants shall have been grown at latitude not more than 325 km (200 miles) north or south of the latitude of the project unless the provenance of the plant can be documented to be compatible with the latitude and cold hardiness zone of the planting location.
2. Color photographs of representative plant material shall be submitted for initial review of alternate nursery sources. Photographs are to include a scale rod or other measuring device and be taken from an angle that depicts the size and condition of the typical plant to be furnished. Photographs must show actual plant material available for selection at that time.

ITEMS 772.339 thru 796.950. (Continued)**Plant Selection / Coordination**

1. For trees, within 90 days of the Notice to Proceed, submit tree sources and schedule selection and tagging of trees so Landscape Architect can tag trees for project at place of growth. The Landscape Architect will perform a trip to the nursery(s) to select and tag trees and a second trip to the nursery(s) review and confirm the acceptability of the trees immediately prior to digging for delivery to the site. Source information shall state the place of growth and the approximate quantity of trees available for inspection. The Landscape Architect may refuse inspection at this time if, in his or her judgment, sufficient quantities of plants are not available for inspection. Lowest tree branching must provide 7'-0" clear pedestrian space at planted condition.
2. For shrubs and other plants, submit plant sources by January 1 of the planting year for Spring plantings, and July 1 for Fall plantings, schedule selection and tagging of shrubs so Engineer can tag representative shrubs for project at place of growth. Source information shall state the place of growth and the approximate quantity of trees available for inspection. The Landscape Architect may refuse inspection at this time if, in his or her judgment, sufficient quantities of plants are not available for inspection.
3. Inform Landscape Architect of selection schedule a minimum of one month (30 day minimum) in advance of selection/tagging dates so Landscape Architect can make proper travel arrangements. If Contractor fails to provide one month (30 day minimum) notice, any additional travel expenses shall be back-charged to Contractor. If Landscape Architect has to make additional trips to select/tag plants in the event that inadequate, insufficient or unacceptable plant material was available at the inspection location, then additional travel expenses to be back charged to Contractor.
4. If nurseries and/or stock submitted for review are not acceptable to Landscape Architect, submit alternate sources within seven (7) business days.
5. If Contractor cannot locate the plant material specified in the Drawings, Contractor shall enlist a plant broker to locate the material. Submit a report from the plant broker describing alternate sources of availability or lack thereof for the specified plant material and sizes.
6. Trips to nurseries shall be efficiently arranged to allow Landscape Architect to maximize his/her viewing time. Only undug trees (trees that are in the ground) shall be considered for approval. Landscape Architect may choose to attach their seal to each plant, or representative samples. Each tree may have a specific location and orientation on the proposed plan that the Contractor shall follow closely during installation.
7. Plant material that has been sealed shall be secured by Contractor within ten (10) business days of Landscape Architect having reviewed or sealed the material.

ITEMS 772.339 thru 796.950. (Continued)

8. Landscape Architect's seals shall not be removed until plantings have been approved by Landscape Architect. Removal of seals prior to Landscape Architect's review of plantings shall be considered grounds for rejection of plant material.

Expenses

1. Contractor to pay for Landscape Architect travel expenses: air fare, car rental, automobile mileage and tolls; meals and overnight accommodations if necessary, for Landscape Architect during time period required to select and tag plant material. Planting subcontractor shall provide representative to travel with Landscape Architect while tagging plant material.

Plant Shipment to Site/ On Site Review

1. Notify Landscape Architect a minimum of five business days prior to each shipment of proposed arrival of plant material on site.

2. Layout tree locations, bed outlines and individual planting on site for inspection by Landscape Architect prior to planting. Arrange for adequate manpower and equipment on site at time of plant material inspection and installation to provide complete staked layout and to unload, open and handle plant material during inspection.

Project/ Site Conditions

Environmental Requirements: do not deliver or handle soils when dry, wet, or frozen.

1. Field Test

- a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
- b. If the soil will not retain shape it is too dry and should not be worked.

If the soil retains shape and will not crumble, it is too wet and should not be worked.

Planting Season: planting seasons shall be those indicated below. Plants planted out-of-season shall receive special attention as directed. Out-of-season planting and or transplanting shall be at Contractor's risk and expense. No planting shall be done in frozen or muddy ground or when snow covers ground, or soil is otherwise in an unsatisfactory condition for planting.

1. Seasons for Planting:

Spring:

Deciduous materials – April 1 to June 15

Evergreen Materials – April 1 to June 15

ITEMS 772.339 thru 796.950. (Continued)

Fall:

Deciduous materials – September 1 - October 15

Evergreen Materials – September 1 - October 15

2. Variance: If special conditions exist that warrant a variance in the above planting dates, a written request shall be submitted to the Landscape Architect a minimum of 4 weeks prior to the scheduled planting date stating the special conditions and the proposed variance. Permission for the variance will be given if warranted in the opinion of the Landscape Architect and upon condition that the Guarantee Period be extended for an additional period of up to 24 months at no additional cost to the Owner.

METHOD OF MEASUREMENT

Items in this section will be measured for payment complete in place, per EACH unit, as determined by the Engineer.

BASIS OF PAYMENT

Items 772.339 thru 796.950 will be paid for at the contract unit price per EACH; which price shall include full compensation for furnishing and installing all plants, mulch, labor, equipment, materials, transportation and other incidentals to complete the work.

<u>ITEM 801.48</u>	<u>4 INCH ELECTRICAL CONDUIT – TYPE NM</u> <u>(8 BANK)</u>	<u>FOOT</u>
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Work under this Item shall be in conformance with the Verizon standards included in the Appendix and the following:

The Contractor shall furnish and install all conduit, sweeps, bends, spacers, concrete encasement and incidentals necessary to install the conduit as shown on the Plans and as required by Verizon.

Measurement for this item shall be per foot as measured along the centerline of the duct bank.

Payment for this item shall be at the unit price, per foot, complete in place, and accepted by Verizon.

<u>ITEM 801.52</u>	<u>5 INCH ELECTRICAL CONDUIT TYPE NM</u> <u>(DOUBLE)</u>	<u>FOOT</u>
<u>ITEM 801.56</u>	<u>5 INCH ELECTRICAL CONDUIT – TYPE NM</u> <u>(6 BANK)</u>	<u>FOOT</u>
<u>ITEM 801.58</u>	<u>5 INCH ELECTRICAL CONDUIT – TYPE NM</u> <u>(8 BANK)</u>	<u>FOOT</u>

Work under these Items shall be in conformance with the NSTAR standards included in the Appendix and the following:

The Contractor shall furnish and install all conduit, sweeps, bends, spacers, concrete encasement and incidentals necessary to install the conduit as shown on the Plans and as required by NSTAR.

Fiberglass conduit for the bridge shall conform to NEMA Standard TC-14B, heavy wall (0.110) nominal wall thickness. Every joint shall be glued with epoxy adhesive.

A single expansion joint shall be placed in the center of the bridge to allow independent (of bridge supports) expansion and contraction of conduit due to temperature changes on the length of the conduit. Stop rings shall be installed around the conduit at the anchor points.

The Contractor shall provide NSTAR with a record drawing as required in their specifications.

Measurement for these items shall be per foot as measured along the centerline of the duct bank. Each measured foot includes all conduit required for the specified item.

Payment for these items shall be at the unit price, per foot, complete in place, and accepted by NSTAR.

ITEM 804.3**3-INCH ELECTRICAL CONDUIT
TYPE NM - PLASTIC (UL)****FOOT**

The work under this Item shall conform to the relevant provisions of Section 800 of the Standard Specifications and the following:

The work shall include the furnishing and installation of the 3-inch non-metallic conduit supplying power to the busway and BRT station lighting systems in accordance with the plans and as directed by the Engineer. The conduit material shall be Schedule 80 polyvinyl chloride (PVC) plastic conduit. The conduit quantity may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 of the Standard Specifications.

Conduit in Grass or in Planted Areas

Where new conduits are installed in grass and planted areas, work shall include placement of a minimum of 4 inches of loam borrow, seed and any other materials replaced in kind to restore disturbed areas to their original condition. Any existing plants (bushes, flowers, etc.) removed or damaged as a result of this project shall be replaced in kind. Loam and seeding shall be measured and paid for under their respective items.

Conduit under Sidewalk or Median Driveways

Where conduit is installed in sidewalk or paved median or asphalt driveway areas, the work shall include excavating and backfilling of trenches, including necessary compaction. Payment for cement concrete or asphalt pavement shall be paid for under the respective item.

Conduit Crossing Roadways

Trenches in existing asphalt pavements not subject to full depth reconstruction shall be sawcut to an 18 inch width. The existing pavements shall be sawcut through their full depth and the pavement removed.

After conduit installation, the trench shall be backfilled with controlled density fill (CDF). CDF shall be Type 2E and shall be as specified in Section M4.08.0 of the Standard Specifications. The finished grade of the CDF shall be below existing pavement surface as shown on the construction details. CDF shall be paid under its respective item.

All conduit shall be installed with a detectable metallic warning tape in accordance with the revised standard drawings for traffic signals.

ITEM 804.3 will be paid for at the Contract Unit Price per FOOT and shall include all labor, material and equipment necessary to install the main power supply for the busway and BRT Station lighting systems. No separate payment shall be made for the sawcutting, excavation, backfill, conduit, wiring, concrete ductbank and all other incidentals to complete the work, but all costs in connection therewith shall be included in the contract unit price for ITEM 804.3.

<u>ITEM 806.41</u>	<u>4 INCH ELECTRICAL CONDUIT – TYPE RM</u> <u>(SPLIT GALVANIZED STEEL)</u>	<u>FOOT</u>
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Work under this item shall be in conformance with the Verizon standards included in the Appendix and the following:

The work consists of furnishing and installing split galvanized steel conduit sleeves for the existing telephone conduit attached to the bridge.

The split galvanized steel conduit sleeves shall be sized to fit the outside diameter of the existing conduit. The split galvanized steel conduit sleeves shall have two interlocking sections that securely attach to each other around the existing conduit. The Contractor shall verify the size of the existing conduit and submit shop drawings of the split galvanized steel conduit sleeve for approval prior to ordering the materials.

All couplings, fittings and clamps needed to connect the split galvanized steel conduit sleeve to the existing conduit shall be included in the cost of this item.

The conduit shall be measured and paid by the foot of conduit installed including all couplings, fittings, clamps and all miscellaneous materials necessary to complete the installation.

ITEM 810.1**CONDUIT ENCASED IN CONCRETE****FOOT**

The work under this Item shall conform to the relevant provisions of Section 800 of the Standard Specifications and the following:

The work shall include the furnishing and installing the ductbank along the Busway consisting of concrete encased conduit and handholes for the communications systems serving the proposed Bus Rapid Transit (BRT) Stations. The work shall be performed in accordance with the plans and as directed by the Engineer.

The ductbank shall contain up to six (6) four inch (4") conduits, generally laid in two rows of three conduits. Concrete shall conform to the relevant provisions of Section 800 and Section 900 of the Standard Specifications.

The conduit material shall be Schedule 80 polyvinyl chloride (PVC) plastic conduit. The conduit quantity may be increased or decreased by the Engineer depending upon actual conditions encountered as provided for in Section 4.06 of the Standard Specifications.

Handholes shall be precast concrete elements rated for HS-20 highway loading, in accordance with the plans. Frames and covers shall be rated for HS-20 loading with the words "MBTA COMMUNICATIONS" cast into the covers.

Conduit Crossing Roadways

Trenches in existing asphalt pavements not subject to full depth reconstruction shall be sawcut to an 18 inch width. The existing pavements shall be sawcut through their full depth and the pavement removed.

After conduit installation, the trench shall be backfilled with controlled density fill (CDF). CDF shall be Type 2E and shall be as specified in Section M4.08.0 of the Standard Specifications. The finished grade of the CDF shall be below existing pavement surface as shown on the construction details. CDF shall be paid under its respective item.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

ITEM 810.1, CONDUIT ENCASED IN CONCRETE will be measured and paid for at the Contract Unit Price per FOOT and shall include all labor, material and equipment necessary to install the ductbank for the busway and BRT Station communications systems.

No separate payment shall be made for the sawcutting, excavation, backfill, conduit, wiring, concrete ductbank, handholes and all other incidentals to complete the work, but all costs in connection therewith shall be included in the contract unit price for Item 810.1.

<u>ITEM 815.1</u>	<u>TRAFFIC CONTROL SIGNAL LOCATION NO. 1</u>	<u>LUMP SUM</u>
<u>ITEM 815.2</u>	<u>TRAFFIC CONTROL SIGNAL LOCATION NO. 2</u>	<u>LUMP SUM</u>
<u>ITEM 815.3</u>	<u>TRAFFIC CONTROL SIGNAL LOCATION NO. 3</u>	<u>LUMP SUM</u>
<u>ITEM 815.4</u>	<u>TRAFFIC CONTROL SIGNAL LOCATION NO. 4</u>	<u>LUMP SUM</u>

Work under these Items shall conform to the relevant provisions of Section 800 of the Standard Specification, the 2009 Manual on Uniform Traffic Control Devices (MUTCD), and the following technical provisions for the following location:

- Location No. 1: Silver Line Busway Approaches to the Broadway Bridge
Proposed Traffic Signal System Installation
- Location No. 2: Everett Avenue at Silver Line Busway Intersection
Proposed Traffic Signal - Infrastructure Elements
- Location No. 3: Spruce Street at Silver Line Busway Intersection
Proposed Traffic Signal - Infrastructure Elements
- Location No. 4: Eastern Avenue at Central Avenue Intersection
Proposed upgrades to existing Traffic Signal System

The work includes complete installation of traffic signals along the Silver Line Busway at the approaches to the existing overhead Broadway Bridge. Work also includes construction of new infrastructure for future traffic signals at the Everett Avenue and Spruce Street intersections in Chelsea, Massachusetts, including mast arms, foundations, conduit, loop detection, wire, cable, and other elements as shown on the plans; and upgrades to the existing traffic signals at the Eastern Avenue and Central Avenue intersection including new pedestrian signals, new loop detectors and upgraded signal control box as shown on the plans.

Nstar will connect power as required. No work shall be done in manholes or on power poles without a representative of Nstar Grid being present. The Contractor will be responsible for coordinating the National Grid work as soon as notice to proceed with construction is given. For the 3 locations, the electrical service shall be on behalf of the Massachusetts Bay Transportation Authority. No direct reimbursement will be made under this contract to the Contractor for payments made to Nstar, full compensation for any payment made by the Contractor to the utility company will be included in the contract prices bid. The Contractor is responsible for power cost until the final acceptance.

A list of major traffic signal items required is included on the plans. Missing from the major items list is Item 804.3 to pay for 3 inch electrical conduit. All other conduit shall be incidental. It is the responsibility of the Contractor to determine the correct pay item numbers from that are listed on the major items list. All major items shall be on the approved equipment list or have their shop drawings approved. The approved equipment list can be downloaded at the following weblink:

<http://www.mass.gov/massdot/highway>

Select Doing business with the Highway Division

Select Design/Engineering

Select Traffic and Safety Engineering

Select Traffic Signal Controls – Approved Equipment List

ITEMS 815.1 thru 815.4 (Continued)

The Contractor shall deliver to the Engineer a certificate of compliance from the manufacturer for all materials purchased from the manufacturer.

The Contractor shall request written approval from the Engineer in advance of the placement of any concrete for foundations of mast arms, signal posts, and cabinets. Concrete foundations shall be constructed of 4,000 psi concrete. The Contractor shall submit shop drawings of any bolt circle details for approval by the Engineer. Anchor bolts shall be set accurately and tops shall be formed neatly. The top forming shall extend downward for a minimum of 12 inches on the side of any foundation. The lower portions of all foundations may be poured directly against undisturbed earth or may be formed at the option of the Engineer.

Flashing Operation

Changes from automatic flashing to stop-and-go operation and from stop-and-go to automatic flashing operation shall occur as set forth in Section 4D-12 of the MUTCD.

Traffic Controller Cabinet

Each traffic signal controller cabinet assembly shall comply with the latest NEMA TS2 specifications in its totality except the following options. The applicable NEMA section is referenced in parenthesis:

- Size 6 Cabinet (7.8.3.2)
- Sheet Aluminum (7.2.2.1)
- Painted (7.7.2) with Exterior & Interior: Primed Aluminum
- Pre-wired with Type 1, Config.#3 Assembly (5.3.1)
- Detector Rack Config.#2 (5.3.4)
- 8 Dual Channel Type C Loop Detectors (6.5.2.2.1)
- Type 2 Controller (3.3)
- Detector input test buttons in cabinet door:
 - 4 Pre-empt
 - 8 Pedestrian Phase
 - 16 Vehicle Channel
- Surge protection with pre-approved independent lab test verification for each device
 - AC Service (5.4.2.4) except surge capacity shall be 80 kA
 - The following lines shall have surge suppression installed according to their respective voltage:
 - 8 Pedestrian detector lines
 - 16 Loop detection lines
 - Surge suppressors (except those for AC Service) shall meet the following specifications:
 - Circuit Type: 3 stage
 - Surge Capacity: 10 kA 8 x 20 μ s impulse per line
 - Resettable Fuse: Positive Temperature Coefficient (PTC)
 - Response Time: <5 ns
 - Testing Param.: ANSI/IEE C62.45
 - Warranty: 10 years (in writing included with above lab report)
- Document Tray

ITEMS 815.1 thru 815.4 (Continued)

- One (1) slide-out document tray shall be mounted below the bottom shelf.
 - Sufficient size to contain cabinet wiring diagrams and two manuals
 - Slides out on nylon rollers or ball bearings
 - Hinged cover to protect documents
 - The closed cover shall be able to support a laptop computer.
- All cables shall be tied away to allow the tray to be opened and closed smoothly without any obstructions.
- Meter Socket
 - Standard residential meter socket with no knock-out on top
 - Rated for 125 Amps, 100 Amps continuous, 600 VAC, CU/AL rated
 - Attached and electrically grounded to the cabinet
 - Three power service unfused terminal connections (AC-, AC+ and ground) having the ability to connect No. 6 AWG conductor
 - Bypass switch to remove meter without disrupting service

The Contractor shall place the standard detector chart on the inside of the controller cabinet door.

All programmable data contained within the controller, malfunction management unit, amplifiers, and other devices shall be printed out, documented, and kept within the cabinet.

All detectors shall be clearly labeled with approach, phase, detector number (if applicable) and cabinet lead-in termination point. The tag shall be made of plastic or plastic laminate and shall be labeled with permanent ink.

There shall be a fourth switch added to Section 815.41.A.3.b that switches the controller from Free operation to Coordinated operation and vice versa.

There shall be two switches for the police door: 1) Main power switch and 2) A switch for switching the controller from automatic to flashing operation and vice versa, with controller power "off" in flashing operation.

A 1/2-inch bead of silicone sealant is required to form a waterproof seal between the controller cabinet and the top of the concrete foundation.

All equipment supplied within the control cabinet shall be on the Massachusetts Department of Transportation Traffic Signal Approved Equipment List, Latest Revision.

The control cabinet shall be initially wired with a "D" harness. All wires for this harness shall be properly terminated on the backpanel.

The cabinet shall also be wired with a normally closed switch connected to a user defined input to the controller for remote monitoring of the control cabinets' door open status.

A concrete pad shall be installed in the front of the controller cabinet (3 feet x cabinet width).

ITEMS 815.1 thru 815.4 (Continued)**TS 2 Type 1 Controller and Cabinet Assemblies**

Controller shall conform to Section 3, Controller Units of NEMA No. TS 2, Traffic Controller Assemblies. The controller and cabinet assemblies shall be supplied in an 8 phase TS 2 Type 1 configuration. Controller shall utilize an input/output interface conforming to Section 3.3.1 of the

NEMA TS 2 Standard for all input/output functions with the backpanel terminals and facilities, the malfunction management unit, detector rack assemblies and auxiliary devices.

The TS 2 Type 1 cabinet shall meet the requirements of configuration 3 as defined in Table 5.3.1-1, "Type 1 Configurations" of the NEMA TS 2 Standard. The cabinet shall be fabricated of sheet aluminum to size six (6) dimensions as specified in Table 7.3-1 of the NEMA TS 2 Standards.

The local traffic controller shall be capable of being operated in the full-actuated mode, in the free mode and as semi-actuated in the coordinated mode. The controller shall be Type 8DW, keyboard entry, menu-driven unit mounted in an eight-phase cabinet. The controller unit shall meet all applicable requirements of the (N.E.M.A.) Standard Publication No. TS-2, Type 1, the Department's 1995 Standard Specifications and include the following as minimum requirements for the "Keyboard Entry Controller Unit."

- a. The Keyboard Entry Controller Unit must be type-tested and approved by the Department.
- b. The controller shall have hard-wire interconnect capability and internal time base coordination logic. The coordination control shall have the capabilities to operate as described under Section 815.41 of the Standard Specifications.
- c. The controller shall have a data transfer/printer port for data transfer to another controller, printer or laptop PC computer. A port shall be provided for uploading or downloading controller operating parameters from a laptop PC computer.
- d. The controller shall have a security code function.
- e. The phase or phases selected for "call to non actuated" (C.N.A.) modes shall be determined as needed by keyboard entries.

The Contractor's attention is directed to Table 2, Required Signal Light Switching Assemblies, Section 815.41 of the Standard Specifications. The Contractor shall furnish the appropriate type and number of load switches and place unutilized load switches in the control cabinet for future use. Load relays shall be easily replaced using a screwdriver. Component relays requiring soldering are not acceptable.

In addition to the convenience outlet as described under Subsection 815.41, a lamp with an on/off switch shall be installed in the controller cabinet.

ITEMS 815.1 thru 815.4 (Continued)**TS 2 Cabinet Power Supply**

A separate power supply shall be supplied and installed in the TS 2 cabinet. The unit shall be AC line powered and provide regulated DC power, unregulated AC power, a line frequency reference for the rack mounted loop amplifiers, bus interface units, load switches, and other auxiliary cabinet equipment as required. As a minimum, the power supply shall meet all requirements of Section 5.3.5 of the NEMA TS 2 Standard.

The power supply shall be either shelf mounted or wall mounted utilizing key hole slots for ease of replacement or installed as part of the rack assembly.

The unit shall contain four LED indicators on the front panel to indicate the four outputs; +12VDC \pm @ 2.0 amps, + 24VDC \pm 2VDC @ 2.0 amps, 12VAC @ 250 milliamps, and 60 Hz line frequency reference. A test point terminal shall also be located on the units front panel for + 24VDC and logic ground testing.

Malfunction Management Unit

The malfunction management unit (MMU) shall comply with Section 4 of the NEMA TS 2 standard. The MMU shall be capable of operating as either a Type 16 with 16 channels (8 vehicle, 4 pedestrian, 4 overlap) or a Type 12 with 12 channels (8 vehicle, 4 overlap). The MMU's supplied shall be configured to operate as Type 16 units.

The MMU's in either the Type 16 or Type 12 configuration shall be capable of operating in a NEMA TS 2 Type 1 cabinet or a NEMA TS 1 cabinet without loss of functionality.

Wire

All wire shall conform to IMSA specifications except IMSA 5. Rubber insulated wires shall not be used due to sunlight and weather deterioration.

The work shall include the furnishing and installation of Type 2 cable as specified in Section 813.21 of the Standard Specifications and IMSA Specification 19-1 (or 20-1) except for the Traffic Signal

Interconnect and Loop Detectors as specified in their respective sections.

Grounding and Bonding

The work shall consist of furnishing and installing covered bonding wire between signal posts, mast arm poles, strain poles, control cabinets and the ground rod at locations directed by the Engineer. The wire shall be Type 10 - #8 wire conforming to materials specification M8.16.10. Installation shall conform to Section 813.61. The Contractor shall perform testing of the equipment grounding system in the presence of the Engineer in accordance with the Standard Specifications. A ground rod shall be installed in each controller cabinet.

ITEMS 815.1 thru 815.4 (Continued)**Load Switches**

Load switches shall comply with Subsection 6.2 of the NEMA TS 2 Standard. All load switches shall utilize optically isolated encapsulated modular solid state relays. Discrete components on circuit boards are not acceptable.

Load switch indicator lights shall be LED-type and wired on the input side of the device.

Note: The controller cabinet assembly shall be initially supplied with a full compliment of load switches to accommodate each available position of the backpanel.

Flasher

Flashers shall comply with Subsection 6.3 of the NEMA TS 2 Standard and be equipped with two output indicator lights which will show flashing power out to the cabinet assembly.

Flash Transfer Relays

Flash transfer relays shall comply with Subsection 6.4 of the NEMA TS 2 Standard.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Note: The controller cabinet assembly shall be initially supplied with a full compliment of flash transfer relays to accommodate each available position of the backpanel.

Vehicle Loop Detectors and Amplifiers

The loop detector amplifiers shall be supplied as two-channel rack mounted units with programmable delay and extension timing, *however, all delay and extension programming shall be completed internally in the controller unit.*

A chart shall be permanently affixed to the controller cabinet door, which labels each amplifier channel. The chart shall indicate the detector number, street name, approach direction, lane assignment, corresponding phase and terminal number for each amplifier channel.

The detector lead-in cables shall also be similarly labeled, both in the controller cabinet and in the pull box containing the detector lead-in splice. This labeling and attachment shall be of durable materials such as brass or plastic, attached by wire or plastic ties. Adhesive attachment of the label shall not be acceptable.

ITEMS 815.1 thru 815.4 (Continued)

All control cabinets shall be supplied with a minimum of four, two-channel rack mounted loop amplifiers unless otherwise noted in the major items list on the plan sheets. Additional rack mounted loop amplifiers shall be supplied if so required by the major items list on the plans.

Wire loop detectors shall be installed in the roadway for vehicle detection. In advance of the loop detector installation, the Contractor shall mark, on site, the loop detectors with any changes required by field conditions such as manholes. The loop detector layout shall be inspected and approved by the Engineer before the loop detectors are installed.

Loop wire shall be encased in a protected plastic tubing of PVC or polyethylene plastic, IMSA 51-5, 1/4-inch outside diameter, and the wire may have cross-linked polyethylene insulation or it may have THHN/THWN insulation.

The heat source for soldering shall be electrical, not exceeding 30W capacity.

Splicing insulator shall be an approved re-enterable body splice kit with a non-hardening sealing compound compatible with the wire insulation. (Klick-it buried wire closure kit manufactured by Communication Technology, Inc., or approved equivalent).

Splice and Connection: Splicing and connection shall be made in the pull box nearest the roadway loop sensor. All loops included in a detector group as shown on the plans shall be spliced in a single pull box. Each lead and lead-in connector shall be stripped back and spliced using a pressure type wire connector applied with a crimping tool. Multiple loop sensors shall be identified as detailed on the plans.

Lead-in splicing shall be staggered to prevent contact with each other. Each crimped splice shall be soldered and insulated. The insulation material shall be heat-shrunked polyolefin. The shielded lead-in cable outer jacket and shield shall be stripped back sufficiently to ensure that the shield cannot come into contact with the spliced conductors. Follow the instructions of the manufacturer when installing the re-enterable splice kit.

NOTE WELL: The above splice shall be done on the day of the loop wire installation to prevent the entrance of any moisture into the plastic tubing.

The lead-in conductors shall be connected to the appropriate terminals in the controller cabinet, by using crimped and soldered terminal ends. The heat source for soldering shall be electrical not exceeding 30W capacity.

Testing of Loops: The test procedure shall be performed in the presence of the Engineer before and after the loop sensor is sealed in the pavement as stipulated in subsection 815.66. The cost of equipment, labor, and materials to perform such testing and similar re- testing following repairs, replacement, or adjustment of any detector within the project area shall be included in the price bid for the traffic control signal items.

ITEMS 815.1 thru 815.4 (Continued)

After installation of wire loop sensors in the roadway and installation of shielded lead-in connecting the loop sensors to the controller cabinet, each loop sensor and lead-in combination shall be tested (at the controller cabinet) for proper installation. The resistance from lead to lead of the same loop shall not exceed three (3) ohms per one thousand (1000) feet as measured by a high quality meter suitable for measurements of low resistance in the range of 1 to 6 ohms.

A megohm meter test at 500 volts DC shall be made between the two leads of a loop/lead-in combination temporarily spliced together, but otherwise disconnected from all terminals, and the shield drain wire and the earth ground connection. These resistances shall be at least one hundred (100) megohms.

A megohm meter test at 500 volts DC shall be made between lead-in shield and the earth ground rod. This resistance shall be at least one hundred (100) megohms.

The meter used for these tests shall be checked for calibration each day of use by using a resistor block of $\pm 5\%$ resistors simulating loads of 1 megohm, 20 megohm and 100 megohms. The observed meter reading shall be $+10\%$ of the nominal resistor load.

If any loop sensor and lead-in combination fails to pass any one of the four (4) tests, it shall be repaired and then re-tested on two occasions at least two (2) weeks apart and then shall pass on each re-test occasion. If the loop sensor lead-in combination does not pass all these re-tests, a new loop sensor and/or lead-in shall be installed, and shall pass these tests, at no additional cost.

After the above tests have been satisfactorily completed, all loop sensor/shielded lead-in inductance shall be measured and a written report of the results shall be filed with the Engineer and a copy stored with the "box prints" at the intersection.

Mast Arm Assemblies

The mast arm assemblies shall conform to the relevant provisions of Subsection 815.43 of the Standard Specifications, and shall be constructed of Type 2 galvanized steel with a transformer shoe base.

The complete mast arm assembly shall be designed, fabricated and constructed in conformance with the MassDOT Mast Arm & Foundation Details and Standard Drawings included in the plans.

Vertical mounting brackets of the type regularly supplied by the manufacturer and conforming to applicable provision of section 815 of the Standard Specifications shall be used for the attachment of signal heads to the mast arm. Sign brackets for mast arms shall be used in all locations where a sign is to be mounted to the mast arm. Mast arm sign brackets shall consist of a mast arm clamp assembly, vertical support tube, stainless steel bands, clamp screw, hardware, and all miscellaneous materials necessary to fix mount the sign to the mast arm.

ITEMS 815.1 thru 815.4 (Continued)

Acceptance of Type 2 mast arm poles will be contingent upon review and approval of shop drawings submitted by the Contractor. All shop drawings and calculations for mast arm assemblies shall bear the seal of a Massachusetts Registered Professional Engineer.

For all mast arm pole foundations, the standard mast arm pole foundation shall be modified to a concrete cored foundation as shown on the Foundation Design Chart of the MassDOT Mast Arm & Foundation Details and Standard Drawings. The lump sum prices bid should assume the dimensions for the foundations are as shown on the plans. Soil exploration borings were conducted by MassDOT and are included with the plans.

Mast Arm Foundations

For all mast arm pole foundations, concrete cored footings shall be provided as shown on the Foundation Design Chart of the MassDOT Mast Arm & Foundation Details and Standard Drawings. The lump sum prices bid should assume the dimensions for the foundations are as shown on the plans. Soil exploration borings were conducted by MassDOT and are included with the plans.

Mast Arm foundations shall not obstruct a sidewalk or crosswalk so that passage by physically-challenged persons would be impaired. The top of all foundations shall be at grade with the finished sidewalk and shall not extend above the sidewalk grade.

Note that the mast arms and foundations at Spruce Street and Everett Avenue shall be fabricated as shown on the Standard Drawings to accommodate future traffic signal heads.

Signal Heads

Signal heads shall be rigid mounted on mast arms, with the bottom of all signals at the same height. All traffic signal lenses shall be 12 inches in diameter unless otherwise noted on the plans. Louvered backplates shall be 5 inches provided on all signal heads as noted on the plans. All signal heads shall be equipped with light emitting diode (L.E.D.) 12 inches modules as noted on the plans.

Signal heads shall be made of aluminum. Signal heads shall be painted yellow with cut away visors unless otherwise noted on the major items list on the plans.

Painting

Vehicle signal housings	-	yellow
Signal housing supports (posts)	-	aluminum
Mast Arms, posts and bases	-	galvanized
Controller cabinet (exterior) & Meter Socket	-	aluminum
Controller cabinet (interior)	-	aluminum
Front of Signal Housings, Visors and Backplates	-	yellow

ITEMS 815.1 thru 815.4 (Continued)**Keys**

Two controller cabinet door keys and police door keys shall be supplied for each controller cabinet on the project.

Traffic Signal LED Module

All signal and pedestrian displays shall be equipped with LED signal modules. All red, amber, green, and pedestrian signal housings with the exception of optically programmed and fiber optic housings and shall conform to the following where applicable:

- ITE's Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Arrow Traffic Signal Supplement, Dated April 3, 2006.
- ITE's Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement, Dated June 27, 2005.
- ITE's Pedestrian and Countdown Signal Modules Compliant to PTCSI - Part 2 Light Emitting Diode (LED), Dated, August, 2007.
- Energy Star / EPACT Program Requirements for Traffic Signals
- On the MassDOT Traffic Signal Approved Equipment List

An independent lab shall certify that the LED signal module complies with the applicable ITE specification. The independent report should be submitted to MassDOT for review unless the module is already on the approved list.

To prevent the LED module warranty from being voided, the connecting leads on the module shall not be cut. The original LED module leads shall be connected to the signal head terminal block as continuous wire without splices.

The LED signal module will be replaced or repaired by the manufacturer if it exhibits one of the following:

A failure due to workmanship or material defects within the first 60 months of field operation

A greater than 40 percent light output degradation or a fall below the minimum intensity levels (as defined by the latest ITE performance specifications) within the first 36 months of field operation

Posts and Bases

Signal posts and bases shall be aluminum shafts with square aluminum bases.

ITEMS 815.1 thru 815.4 (Continued)**Software**

All local controller, malfunction management unit, loop detector amplifier, video detection system, and emergency vehicle preemption software shall be supplied with the latest available revision. Any software upgrades released by the manufacturer shall be supplied at no charge to MassDOT for a period of five years after acceptance of the traffic signal installation.

Documentation

The Contractor shall supply an 8.5 inches x 11 inches laminated copy of the traffic signal as-built plan, sequence and timing chart and detector numbers, street names, approach direction, lane assignment, corresponding phone and terminal number to be left in the cabinet documentation envelope mounted on the inside of the cabinet door. The Contractor shall provide as-built drawings in AutoCAD format and digital photos after the final inspection and prior to final acceptance.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The LUMP SUM Contract price for ITEMS 815.1, 815.2, 815.3 and 815.4 shall be full compensation for all labor, materials, and equipment necessary or incidental to the installation of a complete, fully operational traffic signal control system including electrical conduit for wire loops other than 3 inches conduit, the controller, cabinet and foundation with concrete pad; mast arm poles, anchor bolts and foundations; signal posts and foundations; signal heads; backplates; all cable and wiring; ground rods, equipment grounding and bonding; service connection software, testing system ground and loops, and all said related items in the manner specified and shown, except as itemized below.

Also included in the LUMP SUM Contract price shall be an appropriate portion of that labor and material, which is not intersection specific but system related.

3-Inch Electrical Conduit shall be measured and paid for separately under Item 804.3.

ITEM 815.6**SIGNAL TIMING ADJUSTMENT FOR
BROADWAY/CARY AVENUE****LUMP SUM****SCOPE OF TRAFFIC SIGNAL TIMING ADJUSTMENT WORK**

Traffic signal timing adjustment work consists of traffic signal timing modification at the intersection of Broadway at Cary Avenue. The work required at this location is shown on the Stage 1 Temporary Traffic Control Detour Plan, and shall include all labor, materials, and equipment necessary to complete the traffic signal timing adjustment required to deliver a fully operational temporary traffic signal system during the construction of the Washington Avenue Bridge. Unless otherwise noted, the existing traffic signal operation, timing, and phasing shall be restored to pre-construction conditions for this intersection upon the completion of the Washington Avenue Bridge construction.

GENERAL REQUIREMENTS

The Electrical Contractor performing work on the signals must be on the MassDOT Approved Contractor List and also have International Municipal Signal Association (IMSA) Certification as a Traffic Signal Electrician Level II.

All electrical work performed in association with the traffic signals, whether on State, Municipal, County or Private property, on this contract shall be by licensed electricians holding a "Certificate B". Additionally, the foreman shall be certified as an International Municipal Signal Association (IMSA) Traffic Signal Technician, Level 1 at a minimum.

SIGNAL TIMING ADJUSTMENT

The following description of work specifies the responsibilities involved in the traffic signal timing adjustment at the intersection of Broadway at Cary Avenue.

The Contractor shall coordinate with and obtain permission from the owner of the existing traffic signal prior to beginning work and modifying or restoring existing timing.

The existing traffic signal system at the intersection shall remain operational until the day of the turn on the modified signal system. Unless otherwise noted, existing traffic signal operation, timing, and phasing shall be restored to pre-construction conditions for this intersection upon the completion of the Washington Avenue Bridge construction.

BASIS OF PAYMENT

This LUMP SUM price for Item 815.6 shall constitute full compensation for all labor, materials, and equipment necessary for or incidental to the traffic signal timing adjustments at the intersection of Broadway/Cary Avenue.

ITEM 815.7**EMERGENCY PRE-EMPTION INSTALLATION
AT BROADWAY / CARY AVE INTERSECTION****LUMP SUM****SCOPE OF EMERGENCY PRE-EMPTION INSTALLATION WORK**

The work under this item consists of the installation of emergency vehicle preemption at the intersection of Broadway at Cary Avenue. The work required at this location is shown on the Stage 1 Temporary Traffic Control Detour Plan.

GENERAL REQUIREMENTS

The major emergency vehicle preemption items required at this intersection are shown on the Stage 1 Temporary Traffic Control Detour Plan.

No work shall commence on the signal until approval of the shop drawings and the manufacturer's data has been received in writing from the Engineer. Approval of these drawings shall be general in character and shall not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

The Contractor shall deliver to the Engineer a certificate of compliance from the manufacturer for all materials purchased from the manufacturer.

The Electrical Contractor performing the work on signals must be on the MassDOT Approved Contractor List and also have International Municipal Signal Association (IMSA) Certification as a Traffic Signal Electrician Level II.

All electrical work performed in association with the traffic signals, whether on State, Municipal, County or Private property, on this contract shall be by licensed electricians holding a "Certificate B". Additionally, the foreman shall be certified as an International Municipal Signal Association (IMSA) Traffic Signal Technician, Level 1 at a minimum.

EMERGENCY VEHICLE PREEMPTION

Optically actuated emergency preemption equipment shall be installed for local control of the traffic signal during the passing of appropriately equipped emergency vehicles through the intersection.

The proposed location for the emergency preemption receivers and preemption strobes at the intersection are shown on the Stage 1 Temporary Traffic Control Detour Plan.

The Contractor shall coordinate with and obtain permission from the owner of the existing traffic signal prior to beginning this work.

ITEM 815.7 (Continued)

The emergency vehicle preemption control system shall consist of a data-encoded phase selector to be installed within the traffic control cabinet. This unit will serve to validate, identify, classify and record the signal from the optical detectors located on support structures at the intersection. Upon receiving a valid signal from the detector, the phase selector shall generate a preempt call to the controller initiating a preemption operation as shown on the plan.

The four optical detectors shall be single input, single output units used to control one approach per each.

The Contractor shall install two confirmation strobes at the traffic signal location as shown on the plan.

The Contractor is required to supply material and labor, required or shown, for the complete installation of optical preemption equipment including optical detectors, cable, interfacing equipment to the local controller, making electrical connections and all required incidentals.

The emergency pre-emption system shall be GTT Opticom to be compatible with the City's system.

The Contractor shall provide the Engineer and Owner with electrical diagrams.

The Contractor shall install the equipment consistent with the preemption equipment and the manufacturer's recommended installation procedures and electrical diagrams in a neat and workmanlike manner.

The preemption equipment manufacturer shall be responsible for operational checkouts of the specified preemption functions prior to final acceptance and approval.

Operating checkouts includes the following:

Verifying that the priority system timing and range are properly set.

Preemption equipment warranties are put into effect.

BASIS OF PAYMENT

This LUMP SUM price for ITEM 815.7 shall constitute full compensation for all labor, materials, and equipment necessary for or incidental to the installation of a complete optical vehicle emergency pre-emption system connected to the existing traffic signal controller, as specified at the intersection of Broadway/Cary Avenue.

ITEM 815.8 INSTALL TEMP. FULL VEHICLE SIGNAL CONTROL LUMP SUM
AT WASHINGTON / CARY INTERSECTION**SCOPE OF TEMPORARY FULL VEHICLE SIGNAL CONTROL INSTALLATION WORK**

Temporary full vehicle signal control installation work consists of installing temporary full vehicle signal control at the intersection of Washington Avenue at Cary Avenue. The work required at this location is shown on the Stage 2 Temporary Traffic Control Detour Plan, and shall include all labor, materials, and equipment necessary to complete the full vehicle signal control installation required to deliver a fully operational temporary traffic signal system during the stage 2 construction of the Washington Avenue Bridge. Unless otherwise noted, the existing traffic signal operation shall be restored to pre-construction conditions for this intersection upon the completion of the Washington Avenue Bridge construction.

GENERAL REQUIREMENTS

A list of the major traffic signal items required at this intersection is included on Stage 2 Temporary Traffic Control Detour Plan.

No work on the installation shall be commenced by the Contractor until approval of the shop drawings and the manufacturer's data has been received in writing from the Engineer. Approval shall be general in character and shall not relieve the Contractor from the responsibility of, or the necessity of, furnishing materials and workmanship conforming to the plans and specifications.

The Contractor shall deliver to the Engineer a certificate of compliance with the manufacturer for all materials purchased from the manufacturer.

The Electrical Contractor performing work on the signals must be on the MassDOT Approved Contractor List and also have International Municipal Signal Association (IMSA) Certification as a Traffic Signal Electrician Level II.

The Contractor's attention is directed to a rule of the Board of State Examiners of Electricians which states that the installation of wiring in ducts by Contractors in construction of State Highways will not be permitted unless installed by licensed electricians. The installation of the duct work can be performed by skilled laborers. All electrical work performed in association with the traffic signals, whether on State, Municipal, County or Private property, on this contract shall be by licensed electricians holding a "Certificate B". Additionally, the foreman shall be certified as an International Municipal Signal Association (IMSA) Traffic Signal Technician, Level 1 at a minimum.

ITEM 815.8 (Continued)**TEMPORARY FULL VEHICLE SIGNAL CONTROL INSTALLATION**

The following description of work specifies the responsibilities involved in the temporary full vehicle signal control installation at the intersection of Washington Ave at Cary Avenue.

The Contractor shall coordinate with and obtain permission from the owner of the existing signal prior to beginning installation or restoring existing signal operation.

The existing flashing signal system at the intersection shall remain operational until the day of the turn on the temporary full vehicle signal control system. Unless otherwise noted, existing signal operation shall be restored to pre-construction conditions for this intersection upon the completion of the Washington Avenue Bridge construction, and all the installed items for construction stage 2 vehicle signal operation at this intersection shall be completely removed and returned to MassDOT.

GREEN LED VEHICLE SIGNAL MODULE

The green LED vehicle signal module shall be an approved item from MassDOT's Qualified Traffic Control Equipment List. See "Signal Modules, Vehicle" under "Qualified Traffic Control Equipment" on the Department website:

<http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ApprovedMaterialsandFabricators/QualifiedTrafficControlEquipment/SignalModulesVehicle.aspx>

If the LED module conforms to the latest ITE performance specifications and is Energy Star compliant, it may be submitted for approval to be placed on the Traffic Control Devices Approved Equipment List.

To prevent the green LED module warranty from being voided, the connecting leads on the module shall not be cut. The original LED module leads shall be connected to the signal head terminal block as continuous wire without splices.

The green LED signal module will be replaced or repaired by the manufacturer if it exhibits one of the following:

- A failure due to workmanship or material defects within the first 60 months of field operation.
- A greater than 40 percent light output degradation or a fall below the minimum intensity levels (as defined by the latest ITE performance specifications) within the first 36 months of field operation.

ITEM 815.8 (Continued)**VEHICLE DETECTION VIDEO CAMERAS**

The vehicle detection video cameras and vehicle detection processing unit shall be approved items from MassDOT's Qualified Traffic Control Equipment List. See "Detection, Video" under "Qualified Traffic Control Equipment" on the Department website:

<http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ApprovedMaterialsandFabricators/QualifiedTrafficControlEquipment/DetectionVideo.aspx>

Software shall be supplied with no addition cost and be completely compatible with the existing TS-1 controller.

The Contractor shall supply all other material and labor required for the complete installation of the vehicle detection video cameras including the vehicle detection processing unit to the existing controller, electrical connections and all required incidentals.

BASIS OF PAYMENT

This LUMP SUM price for Item 815.8 shall constitute full compensation for all labor, materials, and equipment necessary for or incidental to the temporary full vehicle signal control installation at the intersection of Washington Ave/Cary Avenue, and to return the controller operations and equipment to the existing flashing operation at the conclusion of Stage 2 construction.

ITEM 820.10**HIGHWAY LIGHTING - ROADWAY****LUMP SUM**

The work under this item shall conform to the relevant provisions of Section 820 of the Standard Specifications and the following:

This item of work shall consist of furnishing and installing lighting systems, complete in place and operable, as indicated on the Contract Documents, including fixtures; fixture mounting hardware including brackets, canopies, hangers, and poles; lamps; auxiliary lighting equipment; conduit and wiring systems, and lighting control equipment for the Silver Line Gateway and Bus Rapid Transit Stations. The elements include, but are not limited to, a new load center, lighting poles along various sections of the busway, bracket arms with LED luminaires to be mounted to the poles, lighting poles along various sections of the shared use path, wallpack fixtures along the underside of the Bellingham Street bridge, and lighting fixtures for the Bus Rapid Transit Stations.

The work under these items shall conform to the relevant provisions of Sections 801, 813 and 820 supplemented and amended by the following:

General

- A. Work under this Section, without limiting the generality thereof, consists of the furnishing and installing of all materials, equipment, labor, testing, transportation of facilities, and all operations and adjustments required for the complete and operating installation of the Lighting Systems as indicated on the Drawings, stipulated in the specifications and as reasonably implied by either or both. This includes but is not limited to the following:
1. Grounding.
 2. New poles and luminaires with foundation, raceways, and wiring.
 3. Underground raceways and wiring complete in new handholes.
 4. Connection of new raceways to new handholes, cabinets, poles, and new raceways.
 5. Connection of new wiring circuits.
 6. New ground rods.
 7. Coordination with utility companies for connection between main power source and new lighting.
- B. Incidental materials necessary for the completion of this installation whether or not specifically mentioned.

Codes, Standards, Ordinances and Permits

- A. Perform all work in strict accordance with all rules, regulations, standards, codes, ordinances, or laws of local, state, and federal authorities having lawful jurisdiction and be responsible for compliance therewith. Such authorities include but are not limited to the following:

ITEM 820.10 (Continued)

1. Massachusetts Electrical Code
 2. Occupational Safety and Health Administration
 3. American Society of Testing Materials (ASTM)
 4. American National Standard (ANSI)
 5. National Fire Protection Association (NFPA)
 6. International Electro-Technical Commission (IEC)
 7. American Association of State Highway and Transportation Officials (AASHTO)
 8. National Electrical Manufacturers Association (NEMA)
 9. Underwriter's Laboratories, Inc. (UL)
 10. City of Chelsea
 11. Massachusetts Bay Transportation Authority
 12. Massachusetts Department of Transportation Highway Division
 13. National Electric Code
- B. The Contractor shall give the proper authority, all requisite notices and secure all permits, licenses, inspections, and certificates relating to this work.
- C. All work performed and all equipment and materials furnished and installed shall be in accordance with all standards as herein specified.

Approvals of Equipment and Materials

Make submittals in accordance with the procedures included elsewhere in these Special Provisions except as modified by the following:

- A. Submit four (4) copies of Shop Drawings and/or manufacturer's literature of all materials and equipment for approval. No work shall commence until Shop Drawings have been stamped approved by the Engineer.
- B. The Contractor shall assume the cost of and the entire responsibility for any change in the work as shown on the Contract Drawings that may be occasioned by 1) approval of materials or equipment other than those specified; 2) any work performed prior to the written acceptance by the Engineer of submittals; and 3) changes due to delays in submitting shop drawings.
- C. All submittals shall be complete. No consideration will be given to partial submittals except with prior approval.
- D. The approval of equipment and material does not relieve the Contractor from the responsibility of Shop Drawing errors in details, sizes, quantities, wiring diagrams, or equipment arrangements, and dimensions that deviate from the Contract Documents and existing job conditions.

ITEM 820.10 (Continued)

E. Submittals shall include but not be limited to:

1. Conduits, fittings, and handholes
2. Wires and cables
3. Poles and foundations
4. Lighting fixtures and luminaires
5. Lighting Control Equipment including power shelter
6. Mounting hardware
7. Photometric data including computerized print-out of illuminance levels.

F. The Contractor shall provide as-built drawings and copies of all warranties within 45 days of final acceptance.

Guarantee

A. Manufacturers shall provide their standard guarantee or as otherwise specified herein for work under this Section, whichever is more demanding. However, such guarantees shall be in addition to and not in lieu of all other liabilities, which the manufacturer and this Contractor have by other provisions of the Contract Documents.

B. All materials, items of equipment, and workmanship furnished under this Section shall carry a warranty against all defects in materials and workmanship for a period of not less than one year from the date of final acceptance by the Authority. Any fault due to defective or improper materials, equipment, workmanship, or design that may develop shall be made good forthwith, by and at the expense of this Contractor, including all other damage done to areas, materials, and other systems resulting from this failure.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion
2. Warranty Period for LED Drivers: Five years from date of Substantial Completion
3. Warranty Period for LED Lumen Depreciation: Lumen Depreciation shall not be more than 10 percent within the five year warranty period starting from date of Substantial Completion.
4. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion
5. Warranty Period for Color Retention: Five years from date of Substantial Completion

C. The Contractor shall furnish, before final payment is made, a written guarantee covering the above requirements.

Quality Assurance

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA-70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

ITEM 820.10 (Continued)

- B. Luminaires, inclusive of the LEDs and LED Driver compartments must be UL-1598 Wet Location listed and IP66 certified
- C. Fixtures and auxiliary equipment shall be listed, labeled or certified by UL.
- D. Replace lamps, which fail within 90 days after final acceptance, at no cost to the Owner.
- E. Installation Tolerances: Deviation from location, alignment and mounting height: 1/2 inch noncumulative in any unit or continuous run of fixtures.
- F. The Engineer reserves the right to request that one fixture from the project production lot be sent to a qualified testing facility for testing to confirm the 3G vibration testing data provided as part of the submittal process. As stated, only one luminaire may be used to illustrate conformance with the 3G testing procedure defined by ANSI C136.31-2001 American National Standard for Roadway Lighting Equipment – Luminaire Vibration. All costs associated with the shipping and testing shall be at the contractor's expense. Determination of acceptability will be by the reviewing Engineer.
- G. Luminaires including power supply shall be RoHS compliant and lead/mercury free.

Production Delivery, Storage & Handling

- A. The Manufacturer is required to ship the lighting fixtures, poles, and accessories securely packaged and labeled for safe handling during shipment to avoid damage or distortion.
- B. Inspect equipment as received. Return for re-placement any equipment damaged in shipment. Equipment shall be stored in a clean, dry, protected area. Retain packing as received from the factory until it is to be installed. Check and seal luminaire openings against rodents and water as necessary.
- C. The Contractor is responsible for storing lighting fixtures, poles and accessories in a secure and dry facility and in original packaging to prevent soiling, physical damage, wetting or corrosion prior to installation.
- D. Contractor must provide for storage inspection by the Engineer after fixtures have been delivered.

Coordination

The Contractor shall coordinate between the luminaire manufacturer and the pole manufacture to ensure that the proposed materials when assembled conform to AASHTO-2003, Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

ITEM 820.10 (Continued)**MATERIALS****General**

1. All equipment furnished including each length of wire, conduit, fitting, fixture, pole, luminaire, device, etc., shall have cast, stamped, or indelibly marked on it by the manufacturer all required information as to indicate that the product is of the type and quality as specified.
2. Drawings and specifications are intended to supplement and explain each other. Materials not specifically mentioned in the specifications shall be as indicated on the Drawings.
3. All materials, equipment, and fixtures shall be new, without imperfections, and shall be furnished, delivered, erected, connected, and finished in every detail.

Load Center

The work shall also consist of furnishing and installing new lighting load center components as shown on the plans for all locations including panel board and time clocks, photoelectric controller, conductors (high voltage and 600V), wiring, hardware and incidentals necessary to provide a complete and operable system. The cabinet shall be NEMA 4X manufactured from grade 316 Stainless Steel. The electric service connection shall be included under this item. Panel board shall be supplied with copper ground bussing only, aluminum bussing is not acceptable.

Typical for all lighting control cabinets and load centers: A scaled drawing shall be submitted showing dimensions and layout of all proposed equipment and devices being installed within the control cabinet or load center building as part of the shop drawing submittal review package. Layout of equipment and devices shall comply with National Electrical Code Article: 110.26.

Cable And Wire

- A. All wire and cable shall conform to the latest requirements of the Massachusetts Electrical Code and shall meet all ASTM standards. Wire and cable shall be new and have the size, grade of insulation, voltage, and manufacturer's name permanently marked on the outer covering at regular intervals and shall be delivered in complete coils or reels with the identifying size, type, and insulation tags. Wire and cable shall be suitably protected from weather and damage during storage.
- B. Low voltage conductors (600V) shall be soft drawn copper with heat and moisture-resistant insulation, service. Minimum wire size shall be number 12 AWG. Conductors No. 10 and larger shall be stranded. Wire size No. 8 and smaller shall be factory color coded with a separate color for each phase and neutral used consistently throughout. Wire and cable No. 6 AWG and larger may be black and color coded at all terminations and splices. Conductors shall conform to the requirements of Section 813. of the Standard Specifications.

ITEM 820.10 (Continued)

- C. Grounding cable installed in the raceways with other cables shall be single conductor, stranded, medium hard drawn annealed copper with 600V insulation, colored green. Other grounding and bonding cable may be bare copper, stranded, or solid.
- D. All cable installed above ground shall have 600V insulation type RHW. All cable installed underground shall have 600V insulation type RHW except as noted on the plans.

Cable Splices And Connections

- A. All low voltage cable splices, taps, and terminations shall be made with solderless connectors. After being made electrically and mechanically secure, the splices and taps shall be covered with sufficient tape or a type that is compatible with the cable insulation and to achieve an insulation level at least equal to that of the conductors. No splices shall be permitted inside conduits.

Light Poles

- 1. Light poles along the Busway shall be square, straight (non-tapered) one piece construction with one flush-welded vertical seam, designed to support the light fixture at 25'-0". The poles shall resist wind loads of 90 mph with a maximum deflection of five percent when fully loaded by their own weight, weight and wind resistance of luminaires they support, and any externally applied loads. All light poles to have a minimum 30 inch concrete base for protection from snow plows. Pole manufacturer shall provide a wireway access through the base of the pole to accommodate (3) 1" conduits. The wireway access shall cover the entire inside opening of the pole shaft. Pole heights shall be as indicated on the Contract Drawings
- 2. Unless otherwise indicated, all poles shall measure nominally 6" x 6" square and are to be manufactured of the same gauge cold rolled steel. The installing contractor shall coordinate all drilling patterns with the pole manufacturer to accept luminaire(s) as required for mountings as well as wireway access and conduit connections. The installing contractor shall field verify base conditions and coordinate with base details shown in contract drawings to assure that no field modification of bases will be required. Pole base and anchor bolts shall be covered by a one piece galvanized shroud and secured to the pole base by stainless steel screws.
- 3. Lighting poles along the Shared Use Path between Station 47+00± and Station 57+00± shall be square, straight (non-tapered) one piece construction with one flush-welded vertical seam, designed to support the light fixture at 15'-0". The poles shall resist wind loads of 90 mph with a maximum deflection of five percent when fully loaded by their own weight, weight and wind resistance of luminaires they support, and any externally applied loads.

Foundations

Foundations for light poles shall be cast-in-place or precast reinforced concrete, in accordance with the details shown on the Drawings.

ITEM 820.10 (Continued)**Lighting Control Equipment**

1. General Requirements: Provide lighting control components suitable for the lighting system specified and compatible for interface with other associated control devices. Lighting control components shall be rated for continuous service and operate satisfactorily in every respect while the branch circuit power supply voltage to each system is within a 110 to 240 volt range at 60 hertz. Electrical contacts shall have precious metal surfaces.
2. Lighting Contactors
 - a. Conform to the applicable requirements of UL 508
 - b. Electrically operated and mechanically held
 - c. Rated at 600 volts, 60 hertz with ampere rating, number of poles and enclosure as indicated
3. Time Switches
 - a. Conform to the applicable requirements of UL887
 - b. Pre-wired with astronomic dial, 36-hour synchronous reserve power motor
 - c. Manual on-auto-off bypass switches for up to three individual circuits.
 - d. Rated at 277 volts, 60 hertz, 40 amperes continuous duty with number of poles, throws and enclosure as rated
4. Photoelectric Sensor
 - a. Conform to the applicable requirements of UL 773
 - b. Operation in temperature range of minus 50°C to plus 60°C
 - c. Dusk to dawn operation with adjustments from two to 50 foot candles with a five-second time delay to preclude false switching.
 - d. Weatherproof and tamperproof
 - e. Acceptable for operation from a supply voltage range of 105 to 285 volts AC.
 - f. Model/manufacturer type as indicated in the drawings.
 - g. Minimum life at rated load: 8000 on-off operations
 - h. Photoelectric sensors shall be mounted facing a northerly direction
 - i. 1 Photoelectric sensors, upon failure, shall default to the “on lighting” position.
5. Wall Switches
 - a. Installed where indicated on the drawings
 - b. Switches: Single unit, toggle, butt contact, quiet type with an integral mounting strap.
 - c. Switch Ratings – for 120 volt circuits: 20 amperes at 120 volts AC
 - d. Switches shall be connected to the wiring with screw clamp type terminals.
 - e. Wall Plates: Type 304 stainless steel.

ITEM 820.10 (Continued)**Luminaires**

1. Luminaires along the Busway and luminaires along the Shared Use Pathway (SUP) shall consist of units as shown on the Plans and include the following options as defined. Finite catalog numbers to be developed by the manufacture and submitted with the shop drawing review process to ensure all options defined are properly incorporated into the product
2. Manufacturer indicated above is provided for sourcing purposes only. Products failing to meet specification requirements shall not be accepted.
3. Luminaires must be UL 1598 listed for installation in wet locations and direct spray environments
4. Manufacturers of Luminaires shall have been in the business for 10+ years, engaged in research, development and marketing of luminaires and shall have patents on these and related products. Qualified manufacturers of Luminaires include: Lithonia, Holophane, H.E. Williams or equal.
5. Comply with IESNA testing and reporting procedures for reporting luminaire photometric performance.
6. Installation environment: The luminaire shall be designed to provide 70,000 hours of life, applicable to the location and environment where fixture is installed (i.e. on a bridge structure, high humidity, vibration, etc.).
7. Metal Parts: Free of burrs and sharp corners and edges.
8. Sheet Metal Components: All materials must be corrosion-resistant aluminum, unless other-wise indicated. Each component shall be formed or supported to prevent warping and sagging.
9. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or de-form in use. All surfaces shall be protected with an electrostatically applied polyester powder coating inside and out; corrosion-resistant passing 3000 hour salt spray test; the luminaire as a complete assembly shall be rated IP66. The EPA shall be less than 1.2 sq. ft. Provide filter/breather for enclosed luminaries.
10. Construction: The luminaire shall be modular to the extent that the optics package and power supply are separate and removable from the housing and that failure of any part thereof would not require total replacement of the luminaire. The optics package and the power supply shall be sealed against the entry of moisture and dirt where the branch circuit enters the housing.
11. Mounting: The housing shall be designed for slip-fit mounting to the end of the arm. The mounting system for the luminaires shall include (2) hot dipped galvanized steel clamp brackets which are secured by means of Two (2) stainless steel mounting bolts on each bracket. This adaptation point shall be designed for standard 2 inch (50mm) schedule 40 tubing. Each clamp shall have a stainless steel through bolt to prevent rotation of the luminaire. The con-tractor shall coordinate with the mounting arm manufacturer to ensure proper positioning of the through bolt.

ITEM 820.10 (Continued)

12. Thermal Management: Heat sink design and spacing shall provide required heat dissipation at the highest operating current but shall be arranged and oriented such that bird droppings and feathers from roosting birds cannot foul the airways and compromise the cooling efficiency. A self-cleaning heat sink design without requiring the use of hose spray is required by this application. The design of the luminaire shall provide the necessary heat dissipation to maintain the driver's case temperature to maximize the life expectancy of the driver to 70,000 hours.
13. Hardware Material: Unless otherwise noted, all hardware shall be Stainless Steel with nylon inserts for all nuts, etc.
14. Branch circuit wiring to the luminaire shall be via the mast arm tenon through the slip fit. Wiring shall be secured inside the luminaire with an integral wire clamp to prevent movement and abrasion.
15. Luminaires shall be rated for operation over the range (-) 40°C to +40°C.
16. Performance: The combined operating life rating of optics package and power supply shall be 70,000 hours minimum where end-of-life shall be taken as the point where lumen output has decreased to 70% of the initial value.
17. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
18. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - White Surfaces: 89 percent
 - Specular Surfaces: 90 percent
 - Diffusing Specular Surfaces: 85 percent
19. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses in luminaire doors. Luminaires shall be provided with the following:
 - a. Fixture to have anti-vermin protection.
 - b. Ballast door and lens frame are each to be secured to housing via a 1/16" galvanized safety cable. This cable shall be long enough as to not interfere with the opening and closing of any doors or covers.
 - c. Luminaire safety cable is to be galvanized steel 1/8" with two crimped ends with loops, Loctite and split lock washers on all bolts.
 - d. Wiring terminal block.
 - e. Teflon, abrasion resistant, safety cable cover.
20. Luminaires for lighting poles along the Busway, Shared Use Path and at the BRT Stations shall consist of light emitting diode (LED) luminaires of wattage as indicated on the Plans.

Light Fixtures on Bridge Piers

1. Light fixtures for units along the Bellingham Street bridge abutments shall consist of a one-piece unit as indicated on the Plans.

ITEM 820.10 (Continued)**LED Drivers**

1. LED drivers used in the luminaires shall be of the luminaire manufacturer's specification, subject to the same operating requirements, quality assurance program and terms of warranty as the luminaire.
2. Type: Switching-type with constant current output; commercial grade with a capacitor life rating of 70,000 hours or better at 63 Deg. C case temperature. Other components with limited shelf life or subject to degradation over time shall not be used on the driver circuit board rated minimum operating life for the driver shall not be less than the operating life of the overall LED package measured to 24% depreciation of initial lumen output.
3. Input Voltage: LED drivers designed for multi-voltage input (120-277V) or (347-480V). 50-60Hz. shall automatically select for the connected voltage or shall be clearly marked at the point of connection for the particular voltage.
4. Drivers shall be overload/overcurrent protected on the AC line side connection preferably with an electronic resettable device or a fuse; fuses shall be protected in tool-less, finger-safe holders and shall be replaceable without removing incoming power.
5. A shielded and replaceable surge protective device (rated ANSI C62.41 Category C) shall be provided integral with the luminaire/driver package to dissipate transient voltages appearing on the AC input.
6. The LED optics package shall be designed to meet the lighting requirements as specified herein with a drive current no greater than 600mA but shall be designed and capable of continuous operation within allowable temperature limits to meet the application requirements.
7. Operating Temperature Range: (-)40 to (+)40 deg. C.
8. The minimum MTBF shall be one million hours in accordance with Telcordia SR-322 per-formed by an independent laboratory at the operating current required by the application and at the maximum rating of the driver.
9. LED driver efficiency shall be 90% or higher with power factor greater than 90% at any drive current.
10. LED driver shall in compliance with FCC 47 CFR Part 15

LEDs

1. Optics package: Consisting of one or more LED modules or 'light bars' each comprised of multiple LED's. The number of LED modules used shall be based on the required lumen out-put to achieve the project illumination design goals defined in field quality control. The op-tics package with the required number of light bars shall also be rated with the housing for 3G vibration. The optics package (light bars) shall be rated IP66.
2. Operating Temperature Range: (-)40 to (+)40 deg. C.

ITEM 820.10 (Continued)

3. Manufacturers of LED's shall have been in the business for 15+ years, engaged in research, development and marketing of LED wafers and shall have patents on these and related products. Qualified manufacturers of LED's include: NICHIA, CREE or equal.
4. LED's used by the luminaire manufacturer shall be identified and direct-sourced from the manufacturer of the LED and shall be certified by the manufacturer of the luminaire as being the LED type and rating used in the manufacture and design of the photometric and thermal characteristics of the particular luminaire.
5. LED's shall be color matched for all light bars on any given luminaire to a Correlated Color Temperature (CCT) of 4000K minimum, 6000K maximum with CRI of 70.
6. Consisting of one or more LED modules or 'light bars' each comprised of multiple LED's connected such that individual LED failures may occur without affecting any other LED's in the column and row where the failed LED occurred.
7. Quality control checks, specifications and binning procedures used by the manufacturer of the luminaire shall be submitted along with the luminaire specification sheets and shop drawings.
8. Light Loss Factor: calculated at 15 years (minimum 11 hours of operation each day) combining Light Lumen Depreciation (LLD) calculated at the maximum operating junction temperature, the Luminaire Dirt Depreciation (LDD) and an efficiency factor relating power supply degradation to light loss shall be greater than 22.5 percent.
9. LED maximum rated junction temperature: The overall design of the thermal package shall provide a temperature margin when operating at the maximum rated driver current in a 40°C ambient temperature not to exceed the maximum allowable LED junction temperature.

Factory Finishes

1. Finish: Manufacturer's standard paint applied to factory-assembled and factory-tested luminaire before shipping.

CONSTRUCTION METHODS**General**

- A. It is the intent of this Section to describe, in general, the installation requirements and the quality of workmanship required by and intended by this Specification.
- B. The Drawings show only the scope of the design, and the Contractor shall be responsible for the proper installation of the equipment in a manner consistent with the installation instructions of the manufacturer, the Drawings, and Specifications and in a manner in conformance with the highest standards of practice of the trade.

ITEM 820.10 (Continued)

- C. The location of conduit and/or wiring as indicated on the Drawings is diagrammatic unless otherwise noted or dimensioned, and the exact locations and lengths shall be determined in the field. The Contractor shall be responsible for the correctness of field dimensions and shall verify all grades, line measurements, and other data that in any way affects the work. The Contractor shall not be entitled to any extra compensation for any additional work or expense arising from his failure to comply with the intent of this paragraph.

Raceways

The Contractor shall install underground conduits and handholes at the approximate locations indicated in the Contract Drawings. The Engineer may indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated in the Contract Drawings or Specifications. Where no size is indicated in the Contract Drawings or Specifications, the ducts shall be not less than 2 inches inside diameter. All duct lines shall be laid so as to grade toward handholes and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to run the grade all one way, the duct lines shall be graded from the center in both directions toward handholes or duct ends.

All new ducts and conduits installed shall be provided with a ¼ inch polypropylene monofilament rope for pulling the permanent wiring. Sufficient length shall be left in handholes to tie the drag wire back to prevent it from slipping back into the duct.

All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

Excavation

Trenches for ducts or conduits can be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed.

If the bottom of the excavation is not considered to be a suitable foundation material by the Engineer, additional material will be excavated and backfilled with a suitable material as directed by the Engineer.

Ducts or Conduit Without Concrete Encasement

Trenches for single duct or conduit lines shall be in accordance with MassDOT Standards. New conduits placed between the NSTAR manholes and the proposed lighting load center(s) shall comply with NSTAR codes and standards. Trench bottoms for ducts without concrete encasement shall be made to conform accurately with the grade so as to provide uniform support for the duct along its entire length.

ITEM 820.10 (Continued)

A layer of fine earth material, at least 4 inches thick (loose measurement), shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft sand or other fine fill, and it shall contain no particles that would be retained on a ¼ inch sieve. The bedding material shall be tamped until firm.

Unless otherwise shown in plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.

Trenches shall be opened the complete length between bases, handholes, etc., before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.

Backfilling - Earth Trench

For ducts without concrete encasement, 8 inches of sand, soft earth, or other fine fill (loose measurement) shall be placed around the ducts and carefully tamped around and over them with hand tampers. The remaining trench may be filled with regular run of excavated material and thoroughly tamped. Turf, sod, and pavement requirements must be met.

The trench shall be backfilled in at least two layers with excavated material no larger than one inch in diameter and thoroughly tamped and compacted to at least the density of the surrounding undisturbed soil. If necessary to obtain the desired compaction, the backfill material must be moistened or aerated as required. Trenches shall not be excessively wet and shall not contain pools of water during the backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that if sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used with proper allowance for settlement, or when the trench is to be paved over the elevation, material, and compaction of the backfill shall conform to the requirements of the paving.

A warning tape shall be installed above underground conduits. Warning tapes shall be 6 inch wide, yellow polyethylene not less than 3.5 mil thick. Tape shall have black lettering on two lines as follows:

CAUTION - CAUTION - CAUTION
BURIED ELECTRICAL LINE BELOW

Where underground conduits terminate above ground, after the pulling of wires and final sandblasting and testing are complete, all of these conduits shall be sealed with ductseal to prevent moisture laden air from circulating inside the enclosure.

After completion of work in any manhole or handhole, both new and existing, the manhole or handhole shall be left in a clean condition satisfactory to the Engineer, regardless of the cause of the debris required to be cleaned.

ITEM 820.10 (Continued)**Cable and Wire**

1. The requirements of the Massachusetts Electrical Code, as currently amended, shall be fully met.
2. All work is subject to inspection and approval of the Massachusetts Bay Transportation Authority (MBTA) and/or the Chelsea Electrical Department. Contractors shall obtain, pay for inspections, and post any and all necessary permits. Copies of all required permits shall be provided to the MBTA and the City of Chelsea Electrical Department Superintendent.
3. All work shall be performed by competent licensed electricians as required by Codes, using quality and quantity of materials at least equal to those specified.
4. City of Chelsea services, utilities, operations, and use of space and facilities shall not be interrupted or affected without the prior consent of the City Engineer(s). Contractors shall coordinate prior arrangements with the City of Chelsea for all operations of this character; shall abide by all such arrangements; and shall provide and pay for all overtime operations and special equipment required for these purposes.
5. Life safety is a primary consideration. The use of rubber mats, gloves, boots, and all other safety equipment and precautions for the work required shall be provided by the Contractor.
6. All cable and circuit runs shall be tagged in each handhole, junction box, and/or enclosure in accordance with the MBTA and/or City of Chelsea electrical department standards.
7. Unless otherwise indicated, all equipment shall be installed to the manufacturer's specifications.

Light Poles

The Contractor shall construct pole bases complete in place at the locations and in conformity with the details shown on the Drawings. The bases shall support the poles and shall incorporate a long sweep bend therein. Sweeps shall be installed and set for 1 inch reveal above the top of the concrete base. No pole shall be set upon a concrete base until a period of at least 72 hours has elapsed after it has been poured. Before anchor bolts are set, the Contractor shall obtain the manufacturer's template for the correct setting of the anchor bolts accommodating the light pole base. A maximum of 3.75 inch bolt reveal will be allowed. The Contractor shall, as part of this work, be prepared to dewater excavations for concrete bases where necessary.

Each pole shall be erected in a truly vertical position, shimmed where necessary on the concrete base.

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Upon completion of the project, the Contractor shall notify the Engineer that all of the lighting systems are operational and shall request an informal inspection by the Engineer, at which time the Engineer will walk the project with the Contractor to establish that all of the lights are operational and that the time clock is set correctly. When this is established, a trial period of 30 consecutive calendar days will commence. Any lamps that burn out during this period will be replaced within 48 hours by the Contractor. Any lamps that burn out during this period will be considered to be defective and will be replaced by the Contractor at his expense. The Engineer and respective MBTA electrical personnel will observe the lighting system closely during this 30 day period and will report system failures and the location of lamp burnouts to the Contractor. As long as the number of lamp burnouts is not excessive, if the systems work without problems for 30 consecutive days, the Engineer will recommend that the MBTA accept their relative systems. If any of these systems fail during the 30 day trial period, the Contractor will repair the system and the 30 consecutive day trial period will commence begin again at the beginning.

Luminaires

1. Luminaire Attachment: Fasten to roadway lighting pole arm with mounting bracket, thru bolt and safety cable. Safety cable is to be looped around the cast bar at the rear for the housing and the both ends are to be secured to the arm with a bolt and a washer.
2. Adjust luminaries that require field adjustment or aiming until values shown in illuminance array are obtained.
3. Cover all chips and scratches on luminaire housings using a protective coating recommended by or provided by the manufacturer of the luminaire.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 820.10 – Highway Lighting - Roadway.

The lump sum price shall include all materials, labor, tools and equipment incidental and necessary for the installation, complete in place including, but not limited to, all lighting poles, foundations, fixtures, luminaires, brackets, stone guard, reflectors, ballasts, floodlights, wiring, plumbing, grouting, shimming, sealing underground ducts, splicing & tagging cables, the lighting load center, and all incidentals required to complete the installation to the satisfaction of the Engineer. Luminaires to be installed on the existing Bellingham Street bridge abutments shall also include all necessary wiring, conduit and connections to the existing lighting system.

ITEM 850.**CONSTRUCTION NOISE CONTROL****LUMP SUM**

1.01 General

- A. The intent of this Section is to minimize construction noise within construction areas, lay-down areas, and communities adjacent to the construction site. It supplements the Construction Noise Control requirements of Division I Subsection 7.02(I)(D). As such, the Contractor and all subcontractors, suppliers, and vendors, are required to comply with all applicable noise regulations, specification requirements, and the noise level limits specified herein.
- B. This Section specifies requirements for response to community complaints. All requirements of this Section, if needed during performance of the Work, shall be overseen by an approved Acoustical Engineer employed by the Contractor.
- C. The Contractor shall use equipment with efficient noise-suppression devices and employ other noise abatement measures such as enclosures and barriers necessary for the protection of the public. In addition, the Contractor shall schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the Work and to occupants of buildings in the vicinity of the Work.
- D. In no case shall the restrictions identified in this Section limit the Contractor's responsibility for compliance with all Federal, state, and local safety ordinances and regulations.

1.02 Terms Used

- A. Noise is any audible sound which has the potential to annoy or disturb humans, or to cause an adverse psychological or physiological effect on humans.
- B. Daytime refers to the period from 7 AM to 6 PM local time daily, except Sundays and Federal holidays.
- C. Evening refers to the period from 6 PM to 10 PM local time daily, except Sundays and Federal holidays.
- D. Nighttime refers to the period from 10 PM to 7 AM local time daily, as well as all day Sunday and Federal holidays.
- E. Noise-Sensitive Locations shall mean locations where particular sensitivities to noise exist, such as residential areas, institutions, hospitals, and parks.
- F. Nuisance Noise refers to sound levels that annoy or disturb a reasonable person of normal sensitivities, but do not exceed the noise limits specified herein.
- G. Lot-line refers to the line separating a parcel of land from another parcel or from the street
- H. Background Noise shall be defined as the measured ambient noise level associated with all existing environmental, transportation, and community noise sources in the absence of any audible construction activity.

ITEM 850. (Continued)

- I. dBA shall be defined as the sound level (in decibels referenced to 20 micro-pascals) as measured using the A-weighting network on a sound level meter, in accordance with ANSI S1.4 Standards.
- J. L_{max} shall be defined as the maximum measured sound level at any instant in time.
- K. Leq shall be defined as the equivalent sound level, or the continuous sound level that represents the same sound energy as the varying sound levels, over a specified monitoring period.
- L. L₁₀ shall be defined as the sound level exceeded 10 percent of the time for a specified monitoring period.
- M. Slow specifies a time constant or 1 second for the root-mean-square (RMS) detector used by a sound level meter, in accordance with ANSI S1.4 Standards.
- N. Impact noise is noise produced from impact or devices with discernible separation in sound pressure maxima. Examples for impact equipment include, but are not limited to; blasting, clam shovel or chisel drops, pavement breakers, jackhammers, hoe rams, mounted impact hammers, and impact pile drivers (but not vibratory pile drivers). Table 2 specifies types of equipment which are considered to emit impact or continuous noise.

1.03 Submittals

- A. Submit (as needed) the name, address, and qualifications of the Acoustical Engineer, as specified in Article 1.05 of this Section for review and acceptance.
- B. Develop and submit for approval, a noise control plan for each phase of construction that outlines in detail, predicted noise impacts and the measures to be implemented by the Contractor to comply with this Section. Any modifications to the approved noise control plan must be submitted for review and approval prior to implementation.
- C. Submit (as needed) shop and working drawings, computations, material data, and other descriptions for abatement measures used as Temporary Noise Barriers, Acoustical Barrier Enclosures, or Noise Control Curtains as specified in Articles 2.03, 2.04, 2.05 of this Section. Drawings and computations shall be stamped by a Registered Professional Engineer of the Commonwealth of Massachusetts.

1.04 Construction Limitations

- A. Noise Levels
 - 1. Daytime, evening, and nighttime construction noise levels at noise-sensitive locations and other noise monitoring locations shall not exceed the limits specified in Table 1, unless the noise exceedances occur when mitigation consistent with this specification is utilized, as determined by the Engineer. The lot-line criteria shall apply to all points on a given lot-line of an affected receptor.

ITEM 850. (Continued)

2. Equipment and associated equipment operating under full load shall not exceed the Lmax noise limits specified in Table 2, unless noise exceedances occur when mitigation consistent with this specification is utilized, as determined by the Engineer. The 50-foot noise emission limits specified in Table 2 shall apply to the entire operation in which the equipment is engaged. Table 2 also provides distinction as to which equipment is considered to emit impact or continuous noise.
3. Work shall be performed in a manner to prevent nuisance conditions such as noise which exhibits a specific audible frequency or tone (e.g., backup alarms, unmaintained equipment, brake squeal) or impact noise (e.g., jackhammers, hoe rams). The Engineer will make any final interpretation concerning whether or not nuisance noise conditions exist. The Engineer has the authority to stop the Work until nuisance noise conditions are resolved, without additional time or compensation for the Contractor.

B. Equipment Operations

1. The use of impact pile drivers shall be prohibited during evening and nighttime hours (i.e., 6 PM to 7 AM as defined in Article 1.02).
2. Vibratory pile driving shall be prohibited during the nighttime period (i.e., 10 PM to 7 AM as defined in Article 1.02).
3. All jackhammers, chainsaws, and pavement breakers used on the construction site shall be enclosed with shields, acoustical barrier enclosures, or noise barriers.
4. The use of all impact devices, including hoe rams, jackhammers, chiseling devices, and pavement breakers, shall be prohibited during the nighttime hours (i.e., 10 PM to 7 AM). Any necessary use of impact devices between 10 PM and 7 AM shall be reviewed by the Engineer in advance and allowed as an exception only upon sufficient justification.
5. Contractors shall use approved haul routes to minimize noise at residential and other sensitive noise receptor sites.
6. All equipment with backup alarms operated during the hours of 6 PM to 10 PM by the Contractor, vendors, suppliers, and subcontractors on the construction site shall be equipped with either audible self-adjusting ambient-sensitive backup alarms or manually-adjustable alarms. The ambient-sensitive alarms shall automatically adjust to a maximum of 5 dBA over the surrounding background noise levels. The manually-adjustable alarms shall be set at the lowest setting required to be audible above the surrounding noise. Installation and use of the alarms shall be consistent with the performance requirements of the current revisions of Society of Automotive Engineering (SAE) J994, J1446, and OSHA regulations.

If work is allowed by the Engineer between the hours of 10 PM to 7 AM, the Contractor shall use in lieu of audible backup alarms an appropriate alternative safety method in accordance with OSHA regulations (29 CFR Part 1926, Subpart "O", 1926.601.b.4 and 1926.602.a.9.) and accepted Health and Safety Plan that is to be submitted by the Contractor. This applies to all vehicles and equipment operated by the Contractor, vendors, suppliers, and subcontractors on the construction site.

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7. Per Section 7.02(I)(C), engine idling for trucks is limited to 5 minutes maximum.

1.05 Acoustical Engineer

- A. The Acoustical Engineer identified in this Article shall oversee all requirements of this Section.
- B. The Acoustical Engineer shall have the following minimal qualifications:
 1. Bachelor of Science or higher degree from a qualified program in engineering, physics, or architecture offered by an accredited university or college, and five years experience in noise control engineering and construction noise analysis; or current enrollment as a full Member or Board-certified Member in the Institute of Noise Control Engineering (INCE).
 2. Demonstrated substantial and responsible experience in preparing and implementing construction noise controls and monitoring plans on construction projects conducted in an urban setting, calculating construction noise levels, and designing and overseeing the implementation of construction noise abatement measures.
- C. If at any point, in the judgment of the Engineer, the quality of the Acoustical Engineer's submittals proves to be repeatedly unacceptable, then the Engineer can require the submittal and selection of an alternative Acoustical Engineer meeting the requirements in this Article.

MATERIALS**2.01 General**

- A. All equipment and materials specified in this part will remain the property of the Contractor or Contractor's subcontractors, vendors, and suppliers, as applicable.

2.02 Noise Reduction Materials and Equipment

- A. Noise reduction materials may be new or used. Used materials shall be of a quality and condition to perform their designed function. Noise reduction equipment and materials may include, but not be limited to:
 1. Shields, shrouds, or intake and exhaust mufflers.
 2. Noise-deadening material to line hoppers, conveyor transfer points, storage bins, or chutes.
 3. Noise barriers using materials consistent with the Temporary Noise Barrier materials specified in Article 2.03 of this Section.
 4. Noise curtains using materials consistent with the Noise Control Curtains materials specified in Article 2.05 of this Section.

ITEM 850. (Continued)

- B. All equipment used on the construction site, including jackhammers and pavement breakers, shall have exhaust systems and mufflers that have been recommended by the manufacturer as having the lowest associated noise.
- C. The local power grid shall be used wherever feasible to limit generator noise. No generators larger than 25 KVA shall be used and, where a generator is necessary, it shall have the maximum noise muffling capability recommended by the manufacturer to meet the noise emission limits specified in Table 2.

2.03 Temporary Noise Barriers**A. Materials**

- 1. Temporary barriers shall be constructed of 3/4-inch Medium Density Overlay (MDO) plywood sheeting, or other material of equivalent utility and appearance having a surface weight of two pounds per square foot (2 lbs/sq.ft.) or greater. The temporary noise barriers shall have a Sound Transmission Class of STC-30, or greater, based on certified sound transmission loss data taken according to ASTM Test Method E90.
- 2. The temporary barriers shall be lined on one side with glass fiber, mineral wool, or other similar noise curtain type noise-absorbing material at least 2-inches thick and have a Noise Reduction Coefficient rating of NRC-0.85, or greater, based on certified sound absorption coefficient data taken according to ASTM Test Method C423.
- 3. The materials used for temporary barriers shall be sufficient to last through the duration of construction for this Contract, and shall be maintained in good repair.

B. Construction Details

- 1. Barrier panels shall be attached to support frames constructed in sections to provide a moveable barrier utilizing the standard "Temporary Precast Concrete Median Barrier" for the Project, or other supports designed to withstand 80 mph wind loads plus a 30 percent gust factor.
- 2. When barrier units are joined together, the mating surfaces of the barrier sides shall be flush with each other. Gaps between barrier units, and between the bottom edge of the barrier panels and the ground, shall be closed with material that will completely fill the gaps, and be dense enough to attenuate noise.
- 3. The barrier height shall be designed to break the line-of-sight and provide at least a 5 dBA insertion loss between the noise producing equipment and the uppermost story of the receptor(s) requiring noise mitigation. If for practicality or feasibility reasons, which are subject to the review and approval of the Engineer, a barrier can not be built to provide noise relief to all stories, then it must be built to the tallest achievable height.

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4. Prefabricated acoustic barriers are available from various vendors. An equivalent barrier design can be submitted as specified in Paragraph 1.03.C. in lieu of the plywood barrier described above.

2.04 Acoustical Barrier Enclosures**A. Materials**

1. The acoustical barrier enclosure shall consist of durable, flexible composite material featuring a noise barrier layer bonded to sound-absorptive material on one side.
2. The noise barrier layer shall consist of rugged, impervious material with a surface weight of at least one pound per square foot (1 lbs/sq.ft.). The sound absorptive material shall include a protective face and be securely attached to one side of the flexible barrier over the entire face.
3. The acoustical material used shall be weather and abuse resistant, and exhibit superior hanging and tear strength during construction. The material shall have a minimum breaking strength of 120 lb/in. per FTMS 191 A-M5102 and minimum tear strength of 30 lb/in. per ASTM D117. Based on the same test procedures, the absorptive material facing shall have a minimum breaking strength of 100 lb/in. and a minimum tear strength of 7 lb/in.
4. The acoustical material shall be corrosion resistant to most acids, mild alkalies, road salts, oils, and grease.
5. The acoustical material shall be fire retardant and be approved by the applicable Fire Department(s) prior to procurement. It shall also be mildew resistant, vermin proof, and non-hygroscopic.
6. The acoustical material shall have a Sound Transmission Class of STC-25 or greater, based on certified sound transmission loss data taken according to ASTM Test Method E90. It shall also have a Noise Reduction Coefficient rating of NRC-0.70 or greater, based on certified sound absorption coefficient data taken according to ASTM Test Method C423.
7. The Contractor shall submit the name of the manufacturer, properties of the material to be furnished, and two one-foot square samples to the Engineer for review prior to submittal of design and detailed engineering as specified in Paragraph 1.03.C.

C. Construction Details

1. The acoustical barrier enclosure shall be designed to effectively cover a noise producing source to reduce noise affecting nearby noise-sensitive receptors.

ITEM 850. (Continued)

2. The acoustical material shall be installed in vertical and horizontal segments with the vertical segments extending the full enclosure height. All seams and joints shall have a minimum overlap of 2 inches and be sealed using double grommets. Construction details shall be performed according to the manufacturer's recommendations.
3. The Contractor shall be responsible for the design, detailing, and adequacy of the framework and supports, ties, attachment methods, and other appurtenances required for the proper construction of the acoustical barrier enclosure.
4. The design and details for the acoustical noise barrier enclosure framework and supports shall be prepared and stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts. The Contractor shall submit the design and detailed engineering drawings to the Engineer as specified in Paragraph 1.03.C.

2.05 Noise Control Curtains**A. Materials**

1. The noise control curtain shall consist of durable, flexible composite material featuring a noise barrier layer bonded to sound-absorptive material on one side. The noise barrier layer shall consist of a rugged, impervious material with a surface weight of at least one pound per square foot (1 lbs/sq.ft). The sound absorptive material shall include a protective face and be securely attached to one side of the flexible barrier over the entire face.
2. The noise curtain material used shall be weather and abuse resistant, and exhibit superior hanging and tear strength during construction. The curtain's noise barrier layer material shall have a minimum breaking strength of 120 lb/in. per FTMS 191 A-M5102 and minimum tear strength of 30 lb/in. per ASTM D117. Based on the same test procedures, the noise curtain absorptive material facing shall have a minimum breaking strength of 100 lb/in. and a minimum tear strength of 7 lb/in.
3. The noise curtain material shall be corrosion resistant to most acids, mild alkalies, road salts, oils, and grease. It also shall be mildew resistant, vermin proof, and non-hygroscopic.
4. The noise curtain material shall be fire retardant and be approved by the City and/or Town Fire Departments prior to procurement.
5. Noise control curtain shall have a Sound Transmission Class of STC-30 or greater, based on certified sound transmission loss data taken according to ASTM Test Method E90. It shall also have a Noise Reduction Coefficient rating of NRC-0.85 or greater, based on certified sound absorption coefficient data taken according to ASTM Test Method C423.
6. The Contractor shall submit the name of the manufacturer, properties of the material to be furnished, and two one-foot square samples to the Engineer for review prior to submittal of the design and detailed engineering drawings as specified in Paragraph 1.03.C.

ITEM 850. (Continued)**B. Construction Details**

1. The noise control curtains shall be designed to effectively reduce noise affecting nearby noise-sensitive receptors. The curtains shall be secured above, at the ground, and at intermediate points by framework and supports designed to withstand 80 mph wind loads plus a 30 percent gust factor.
2. The curtains shall be installed in vertical and horizontal segments with the vertical segments extending the full curtain height to the ground. All seams and joints shall have a minimum overlap of 2 inches and be sealed using Velcro or double grommets spaced 12 inches on center. Curtains shall be fastened to framework and guardrails with wire cable 12 inches on center. Construction details shall be performed according to the manufacturer's recommendations.
3. The curtain height shall be designed to break the line-of-sight and provide at least a 5 dBA insertion loss between the noise producing equipment and the upper-most story of the receptor(s) requiring noise mitigation. If for practicality or feasibility reasons, which are subject to the review and approval of the Engineer, a curtain system cannot be built to provide noise relief to all stories, then it must be built to the tallest achievable height.
4. The Contractor shall be responsible for the design, detailing, and adequacy of the framework and supports, ties, attachment methods, and other appurtenances required for the proper installation of the noise control curtains.
5. The design and details for the noise control curtains framework and supports shall be prepared and stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts. The Contractor shall submit the design and detailed engineering drawings to the Engineer as specified in Paragraph 1.03.C.

CONSTRUCTION METHODS**3.01 Noise Reduction Methods**

A. The Contractor shall use all reasonable efforts to implement noise reduction methods listed below to minimize construction noise emission levels. Noise reduction methods shall include, but not be limited to:

1. Use of: 1) concrete crushers or pavement saws for concrete deck removal, demolitions, or similar construction activity; 2) pre-auguring equipment to reduce the duration of impact or vibratory pile driving; 3) local power grid to reduce the use of generators.
2. Attaching: 1) intake and exhaust mufflers, shields, or shrouds; 2) noise-deadening material to inside of hoppers, conveyor transfer points, or chutes.
3. Maintaining: 1) equipment mufflers and lubrication; 2) precast decking or plates; 3) surface irregularities on construction sites to prevent unnecessary noise.

ITEM 850. (Continued)

4. Limiting: 1) the number and duration of equipment idling on the site; 2) the use of annunciators or public address systems; 3) the use of air or gasoline-driven hand tools.
5. Configuring, to the extent feasible: 1) the construction site in a manner that keeps loud equipment and activities as far as possible from noise-sensitive locations; 2) barrels or signage to detour traffic away from plated trenches.
6. Scheduling of construction events and limiting usage times to minimize noise, especially during nighttime hours and near sensitive abutters.
7. Constructing noise barriers and/or noise curtain systems.
8. Minimizing noise from the use of backup alarms using measures that meet OSHA regulations. This includes use of self-adjusting ambient-sensitive backup alarms, manually-adjustable alarms on low setting, use of observers, and scheduling of activities so that alarm noise is minimized.
9. Where practical and feasible, configuring construction sites to minimize backup alarm noise. For example, construction site access should be designed such that delivery and dump trucks move through the site in a forward manner without the need to back up.
10. Preventing nuisance noise conditions such as from squealing equipment, backup alarms, radios and public address systems, etc.
11. Using only variable message and sign boards that are solar powered or connected to the local power grid

3.02 Temporary Noise Barriers

- A. The Contractor shall erect temporary noise barriers to mitigate construction noise at locations as directed by the Engineer.
- B. The temporary noise barriers shall be readily moveable so that they may be re-positioned, as necessary, to provide noise abatement for non-stationary, as well as stationary, processes.
- C. The barriers shall be installed such that the noise-absorptive surfaces face the construction noise source.
- D. The Contractor shall maintain the temporary noise barriers and repair all damage that occurs, including, but not limited to, keeping barriers clean and free from graffiti and maintaining structural integrity. Gaps, holes, and weaknesses in the barriers, and openings between or under the units, shall be repaired promptly or replaced by the Contractor with new material.
- E. The Contractor shall remove and dispose of the temporary noise barriers at the end of the Contract or sooner at the direction of the Engineer.

ITEM 850. (Continued)

3.03 Complaint Procedure

- A. The Objective of the complaint procedure is to ensure that public and agency complaints are addressed and resolved consistently and expeditiously.
- B. If the Contractor receives a complaint regarding construction noise, the Contractor shall immediately notify the Engineer and the Acoustical Engineer.
- C. The Contractor shall immediately respond to the complaint by measuring noise levels in the vicinity of the complaint(s) and take noise measurement readings as necessary. In the event that measured noise levels exceed allowable limits as specified in Article 1.04 of this Section, or is resulting in nuisance conditions, the Contractor shall immediately use noise reduction materials and methods such as, but not limited to, those described in Article 3.01 to reduce noise levels or to alleviate the nuisance conditions. The Contractor shall also provide a response to the person(s) who filed the noise complaint within 24 hours.

3.04 Acoustical Barrier Enclosures

- A. The Contractor shall erect acoustical barrier enclosures to mitigate construction noise at locations as required in construction drawings, or as directed by the Engineer.
- B. The acoustical barrier enclosures shall be readily moveable so that they may be repositioned, as necessary, to provide noise abatement for non-stationary equipment (e.g., jackhammers, chain saws, compressors).
- C. The acoustical enclosure shall be installed such that the noise-absorptive surfaces face the construction noise source.
- D. The Contractor shall maintain the acoustical barrier enclosures and repair all damage that occurs, including, but not limited to, keeping barriers clean and free from graffiti and maintaining structural integrity. Gaps, holes, and weaknesses in the acoustical enclosure, and openings between or under the panels, shall be repaired promptly or replaced by the Contractor with new material. Construction work shall not proceed until repairs are made.
- E. The Contractor shall remove and dispose of the acoustical enclosure at the end of the Contract or sooner at the direction of the Engineer.

3.05 Noise Control Curtains

- A. The Contractor shall erect noise control curtains to mitigate construction noise at locations specified in construction drawings, or as directed by the Engineer.
- B. Noise control curtains shall particularly be used for short-term operations (e.g., less than 3 months), or where vehicular or pedestrian access is required during the day, or as directed by the Engineer.

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- C. The noise control curtains shall be installed without any gaps such that the sound-absorptive side faces the construction activity to be shielded. The curtains shall be supported by the existing elevated Expressway, ramps, or other methods identified by the Contractor.
- D. The Contractor shall maintain the noise control curtains and repair all damage that occurs, including, but not limited to, keeping barriers clean and free from graffiti and maintaining structural integrity. Gaps, holes, and weaknesses in the noise control curtains, and openings between or under the panels, shall be repaired promptly or replaced by the Contractor with new material. Construction work shall not proceed until such repairs are made.
- E. The Contractor shall remove and dispose of the noise control curtains at the end of the Contract or sooner at the direction of the Engineer.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under this item, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for Item No. 850. – Construction Noise Control. The LUMP SUM price shall include all materials, labor, tools and equipment incidental and necessary to complete the work as specified herein.

TABLE 1: Construction Noise Lot-Line Limits in dBA

Period of the Day	Hours	Land-use	Non-Impact Equipment			Impact Equipment		
			Leq	L10	Lmax	Leq	L10	Lmax
Daytime	7:00 am to 6:00 pm	Noise-sensitive	n/a	75 or Bkgrd+5 (a)	85 (a)	n/a	n/a	90
		Commercial	n/a	80 or Bkgrd +5 (a)	--	n/a	n/a	--
		Industrial	n/a	85 or Bkgrd +5 (a)	--	n/a	n/a	--
Evening	6:00 to 10:00 pm	Noise-sensitive	n/a	Bkgrd +5	85	n/a	n/a	85
Nighttime	10:00 pm to 7:00 am	Noise-sensitive:						
		BL < 70 dBA	n/a	Bkgrd +5	80	n/a	n/a	n/a
		BL > 70 dBA	n/a	Bkgrd +3	80	n/a	n/a	n/a

NOTES:

- (a) Noise from impact equipment is exempt from the L10 requirement, however is still subject to a lot-line Lmax limit.
- (b) All measurements shall be taken at the affected lot-line. In situations where the work site is within 50 feet of a lot-line, the measurement shall be taken from a point along the lot-line such that a distance of 50 feet is maintained between the sound level meter and the construction activity being monitored.
- (c) Lot-line noise limits shall apply to all points along the receptor's lot-line
- (d) L10 noise readings are averaged over 20 minute intervals. Lmax noise readings occur instantaneously.
- (e) L is the average baseline or background measured in L10.

ITEM 850. (Continued)

TABLE 2: Construction Equipment 50-Foot Noise Emission Limits (a), (b)

<u>Equipment Category</u>	<u>at 50 ft, dBA, slow</u>	<u>Impact Device? (c)</u>	<u>Factor (d)</u>	
All other equipment > 5 HP	85	No	50 %	
Auger Drill Rig	84	No	20 %	
Backhoe	78	No	40 %	
Bar Bender	80	No	20 %	
Blasting	94	Yes	1 %	
Boring Jack Power Unit	80	No	50 %	
Chain Saw	84	No	20 %	
Clam Shovel	87	Yes	20 %	
Compactor (ground)	80	No	20 %	
Compressor (air)	78	No	40 %	
Concrete Batch Plant	83	No	15 %	
Concrete Mixer Truck	79	No	40 %	
Concrete Pump Truck	81	No	20 %	
Concrete Saw	90	No	20 %	
Crane (mobile or stationary)	81	No	20 %	
Dozer	82	No	40 %	
Drill Rig Truck	79	No	20 %	
Drum Mixer	80	No	50 %	
Dump Truck	76	No	40 %	
Excavator	81	No	40 %	
Flat Bed Truck	74	No	40 %	
Front End Loader	79	No	40 %	
Generator (25 KVA or less)	73	No	50 %	
Generator (more than 25 KVA)	81	No	50 %	
Gradall	83	No	40 %	
Grader	85	No	40 %	
Grapple (on backhoe)	85	No	40 %	
Horizontal Boring Hydraulic Jack	80	No	25 %	
Hydra Break Ram	90	Yes	20 %	
Impact Pile Driver (diesel or drop)	95	Yes	20 %	
Insitu Soil Sampling Rig	84	No	20 %	
Jackhammer	85	Yes	20 %	
Man Lift	75	No	20 %	
Mounted Impact Hammer (hoe ram)	90	Yes	20 %	
Paver	77	No	50 %	
Pavement Scarifier	85	No	20 %	
Pickup Truck	75	No	40 %	
Pneumatic Tools	85	No	50 %	
Pumps	77	No	50 %	
Refrigerator Unit	73	No	100 %	
Rivet Buster / Chipping Gun	79	Yes	20 %	
Rock Drill	81	No	20 %	
Roller	80	No	20 %	
Sand Blasting	90	No	20 %	
Scraper	84	No	40 %	
Shears (on backhoe)	90	No	40 %	
Slurry Plant	78	No	100 %	
Slurry Trenching Machine	80	No	50 %	
Soil Mix Drill Rig	80	No	50 %	
Tractor	84	No	40 %	
Vacuum Excavator (vac-truck)	85	No	40 %	
Vacuum Street Sweeper	80	No	10 %	
Ventilation Fan	79	No	100 %	
Vibrating Hopper	85	No	50 %	
Vibratory Concrete Mixer	80	No	20 %	
Vibratory Pile Driver	95	No	20 %	
Warning Horn	83	No	5 %	
Welder / Torch	73	No	40 %	

NOTES:

- (a) Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.
- (b) Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
- (c) “Impact” equipment is assumed to produce separate discernable sound pressure maxima.
- (d) “Acoustic Usage Factor” represents the percent of time that equipment is assumed to be running at full power while working on site.

ITEM 854.014**TEMPORARY PAVING MARKINGS -
4 INCH (PAINTED)****FOOT**

The work under this Item shall consist of the furnishing, applying, maintaining and removing temporary painted pavement markings at the locations shown on the Plans, as required by the Engineer, and in conformance with the relevant provisions of Section 850 of the Standard Specifications and the following:

The pavement marking materials shall conform to Subsection 850.44 of the Standard Specifications and shall be lead-free.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Temporary Pavement Markings shall be measured by the procedure outlined in Subsection 860.80 of the Standard Specifications. Payment for Temporary Pavement Markings will include full compensation for furnishing, installing, maintaining and removing the markings.

ITEM 874.1
ITEM 874.2**STREET SIGN REMOVED AND RESET**
TRAFFIC SIGN REMOVED AND RESET**EACH**
EACH

The work under these Items shall conform to the relevant provisions of Section 840 of the Standard Specifications and the following:

The work to be done consists of removing and resetting the existing street, warning and regulatory signs and their supports to new locations as shown on the Plans or as required by the Engineer.

The Contractor shall replace at his own expense, all sign panels and supports that are damaged or lost either directly or indirectly as a result of his actions.

Materials for street signs and traffic signs removed and reset shall be the existing signs. If in the opinion of the Engineer, the existing sign panel is unsuitable for re-use due to the Contractor's negligence, a new sign panel of a size and composition equal to the existing sign panel, shall be furnished, as required by the Engineer.

The signs shall be mounted in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and the 1990 Standard Drawings for Signs and Supports.

When the visibility of the relocated sign panels is obstructed by trees and other vegetation, the Contractor shall clear the obstruction for proper sight distance. All clearing shall be done within the roadway layout, as approved by the Engineer.

All sign panels, to be removed and re-set, shall be cleaned before being reset.

Damage during removal or re-setting to any sign panel designated for reuse by the Engineer shall be repaired or replaced by the Contractor at his own expense.

Street and traffic signs shall be measured as single units, complete in place, as determined by actual count.

BASIS OF PAYMENT

These ITEMS shall be paid for at the contract unit price per EACH and shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals, and for performing all the work, including excavation and backfill, involved in removing and resetting signs. The price shall also include all necessary mounting fixtures (nuts, bolts and other miscellaneous items) to complete the work.

If required by the Engineer, new sign posts for street and traffic signs shall be paid for separately under ITEM 847.1, SIGN SUPPORT (NOT GUIDE) AND ROUTE MARKER WITH 1 BREAKAWAY POST ASSEMBLY - STEEL.

ITEM 874.41 **TRAFFIC SIGN REMOVED AND DISCARDED** **EACH**

Work under this item includes the dismantling, removal, and disposal of the existing roadside signs shown on the plans together with the sign supports and their foundations.

The existing signs shall not be removed until the new signs and structures replacing them are ready for traffic or until the Engineer shall permit.

All signs that are to be removed and discarded shall become the property of the Contractor and shall be disposed of off the site.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work described above will be measured by the unit "EACH".

Payment for work to be done under this ITEM will be by the unit EACH, which price will be full compensation for dismantling, loading, transporting and stacking of the signs as described above, the excavating and disposal of the existing foundation and supports of the same, and the supplying and placing of compacted gravel backfill where foundations and posts are removed, and restoration of surface.

ITEM 874.6 **TEMPORARY MASKING OF SIGNS** **SQUARE FOOT**

The work to be done under this item shall conform to the applicable provisions of Section 850 of the Standard Specifications and the following.

The Contractor shall completely mask or cover existing sign panels whose message conflicts with the temporary detour plan.

Masking material shall be black in color and completely cover the sign panel without damaging the sign. The Contractor shall maintain the masking in good condition so the message is completely covered for the required duration. Damaged masking material shall be replaced by the Contractor at no additional cost. The Contractor shall remove and dispose of the masking material when the temporary detour is not in use.

Signs damaged by the masking material or Contractor's negligence shall be replaced by the Contractor at no additional cost.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement shall be per SQUARE FOOT as measured on the message side face of each sign panel covered.

The contract unit price paid for each sign masked shall include full compensation for furnishing, maintaining, removing and disposing the masking including all labor, tools, materials, equipment and incidentals involved to complete this item.

ITEM 874.8 MBTA BUS ROUTE 111 TEMPORARY BUS STOP SIGNS EACH

Work under this Item shall conform to the applicable provisions of Section 828 of the Standard Specifications and the following:

The Contractor shall furnish, install and remove temporary bus stop signs at the locations shown on the plans.

The bus stop signs shall be as specified by the MBTA.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Temporary bus stop signs shall be measured as single units, complete in place, as determined by actual count.

The contract unit price paid for EACH sign shall include full compensation for furnishing all labor, tools, materials, equipment and incidentals, necessary to complete this item.

ITEM 918.100
ITEM 918.300**MASONRY CLEANING**
MASONRY REPOINTING**SQUARE FOOT**
FOOT**GENERAL**

The work under these items shall include:

1. Cleaning exposed stone masonry surfaces.
2. Repointing mortar joints.

DEFINITIONS

- Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
- Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.

SUBMITTALS

1. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.
2. Samples for Verification: Before erecting mockup, submit samples of each type of sand used for pointing mortar. For blended sands, provide samples of each component and blend. Identify sources, both supplier and quarry, of each type of sand.
3. Qualification Data: For restoration specialists including field supervisors.
4. Restoration Program: For each phase of restoration process, provide detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials on the Project site.
 - a. Include methods for keeping pointing mortar damp during curing period.
 - b. If materials and methods other than those indicated are proposed for any phase of restoration work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.
5. Cleaning Program: Describe cleaning process in detail, including materials, methods, and equipment to be used and protection of surrounding materials on the Project site, and control of runoff during operations. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on comparable projects, and a testing program to demonstrate their effectiveness for this Project.

QUALITY ASSURANCE

1. Restoration Specialist Qualifications: Engage an experienced masonry restoration and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

ITEM 918.100 & ITEM 918.300 (Continued)

- a. Field Supervision: Restoration specialist firms shall maintain experienced full-time supervisors on Project site during times that stone masonry restoration and cleaning are in progress. Supervisors shall not be changed during Project except for causes beyond the control of restoration specialist firm.
 - b. Restoration Worker Qualifications: Persons who are experienced and specialize in restoration work of types they will be performing.
2. Chemical Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.
3. Source Limitations: Obtain each type of material for masonry restoration (stone, cement, sand, etc.) from one source with resources to provide materials of consistent quality in appearance and physical properties.
4. Mockups: Prepare mockups of cleaning as follows to demonstrate aesthetic effects and qualities of materials and execution. Prepare mockups on existing walls under same weather conditions to be expected during remainder of the Work.
 - a. Clean an area approximately 25 sq. ft. in area for each type of clay masonry and surface condition.
 1. Test cleaners and methods on samples of adjacent materials for possible adverse reactions unless cleaners and methods are known to have deleterious effect.
 2. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - b. Rake out joints in two separate areas approximately 36 inches high by 72 inches wide for each type of repointing required and repoint one of the two areas.

DELIVERY, STORAGE, AND HANDLING

2. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
4. Store lime putty covered with water in sealed containers.
5. Store sand where grading and other required characteristics can be maintained and contamination avoided.

ITEM 918.100 & ITEM 918.300 (Continued)**PROJECT CONDITIONS**

1. Repoint mortar joints only when air temperature is between and 40 and 90 deg F and is predicted to remain so for at least 7 days after completion of work.
2. Cold-Weather Requirements: Comply with the following procedures for mortar-joint pointing:
 - a. When air temperature is below 40 deg F, heat mortar ingredients and existing masonry walls to produce temperatures between 40 and 120 deg F.
 - b. When mean daily air temperature is below 40 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 7 days after repair and pointing.
3. Hot-Weather Requirements: Protect masonry mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F and above.
4. Clean masonry surfaces only when air temperature is 40 deg F and above and is predicted to remain so for at least 7 days after completion of cleaning.

SEQUENCING AND SCHEDULING

1. Order replacement materials at earliest possible date, to avoid delaying completion of the Work.
2. Perform masonry restoration work in the following sequence:
 - a. Rake out joints that are to be repointed.
 - b. Point mortar joints.
 - c. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 - d. Clean stone surfaces.
 - e. Rake out joints that are to be repointed.
 - f. Point mortar joints.
3. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units to comply with Part 3 "Masonry Unit Patching" Article. Patch holes in mortar joints to comply with Part 3 "Repointing Masonry" Article.

MATERIALS

When selecting products from manufacturers, available products shall be subject to compliance with requirements; products that may be incorporated into the Work include, but are not limited to, the products specified. Available manufacturers are subject to compliance with requirements; manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

ITEM 918.100 & ITEM 918.300 (Continued)**Mortar Materials**

1. Portland Cement: ASTM C 150, Type I or Type II. Provide white cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
2. Hydrated Lime: ASTM C 207, Type S.
3. Mortar Sand: ASTM C 144, unless otherwise indicated. Provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color. For pointing mortar, provide sand with rounded edges. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands, if necessary, to achieve suitable match.
4. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
5. Water: Potable.

Paint Removers

Use Low-Odor, Solvent-Type Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type gel formulation, containing no methanol or methylene chloride, for removing paint coatings from masonry.

The following paint removers are acceptable for use provided that the requirements of this specification are met.

- a. Super Bio Strip Gel American Building Restoration Products, Inc.
- b. Peel Away 6, Dumond Chemicals, Inc.
- c. Enviro Klean NMC, ProSoCo

Cleaning Materials

1. Water for Cleaning: Potable.
2. Hot Water: Heat water to a temperature of 140 to 160 deg F.
3. Job-Mixed Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate (TSPP), 1/2 cup of laundry detergent, and 20 quarts of hot water for every 5 gal. of solution required.
4. Job-Mixed Mold, Mildew, and Algae Remover: Solution prepared by mixing 2 cups of tetrasodium polyphosphate (TSPP), 5 quarts of 5 percent sodium hypochlorite (bleach), and 15 quarts of hot water for every 5 gal. of solution required.

ITEM 918.100 & ITEM 918.300 (Continued)

5. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents and chelating agents and is specifically formulated for cleaning masonry surfaces.

The following nonacidic gel cleaners are acceptable for use provided that the requirements of this specification are met.

- | | |
|---|--|
| a. Price Marble Cleaner-Gel
Price Research, Ltd. | b. Sure Klean 942 Masonry Cleaner
ProSoCo |
|---|--|

6. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood. The following nonacidic liquid cleaners are acceptable for use provided that the requirements of this specification are met.

- | | |
|--|--|
| a. Bio-Cleanse
Dominion Restoration, Inc. | b. Safe n' Easy Architectural Cleaner/Restorer
Dumond Chemicals, Inc. |
| c. Enviro Klean Restoration Cleaner
ProSoCo | |

Miscellaneous Materials

1. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners. . The following liquid strippable masking agents are acceptable for use provided that the requirements of this specification are met.

- | | |
|---|--|
| a. LM 130 Acid Shield
American Building Restoration Products, Inc. | b. Diedrich Acid Guard
Diedrich Technologies Inc. |
| c. Sure Klean Strippable Masking
ProSoCo | |

Mortar Mixes

1. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer. When mixing pointing mortar, thoroughly mix cementitious materials and sand together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

ITEM 918.100 & ITEM 918.300 (Continued)

2. Colored Mortar: Produce mortar of color required by using selected ingredients. Do not alter specified proportions without Engineer's approval. Where mortar pigments are indicated, do not exceed a pigment-to-cement ratio of 1:10 by weight.
3. Do not use admixtures of any kind in mortar, unless otherwise indicated.
4. Mix mortar materials in the following proportions: 1 part Portland cement, 2 parts lime, and 6 parts sand. Add mortar pigments to produce mortar colors required. Rebuilding (Setting) Mortar shall be as same as pointing mortar. For Rebuilding (Setting) Mortar: Comply with ASTM C 270, Proportion Specification, Type N, unless otherwise indicated; with cementitious material content limited to Portland cement and lime.

Chemical Cleaning Solutions

Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended by chemical cleaner manufacturer.

CONSTRUCTION METHODS**Protection**

1. Protect persons, railroad, surrounding surfaces of walls being restored, project site, plants, and surrounding structures from harm resulting from masonry restoration work. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of restoration and cleaning work.
2. Comply with chemical cleaner manufacturer's written instructions for protecting wall and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with pedestrians, railroad, landscaping, structures, and other surfaces that could be harmed by such contact.
 - a. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - b. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - c. Do not clean masonry stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - d. Neutralize and collect alkaline and acid wastes for disposal off Authority's property.
 - e. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations and damage to landscaping.

ITEM 918.100 & ITEM 918.300 (Continued)

3. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - a. Cover sills, ledges, and projections to protect from mortar droppings.
 - b. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
 - c. Immediately remove mortar in contact with exposed masonry stone and other surfaces.
 - d. Clean mortar splatters from scaffolding at end of each day.

Cleaning Stone Masonry, General

1. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.
2. Use only those cleaning methods indicated for each masonry material and location.
 - a. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
 - b. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone masonry. Equip units with pressure gages.
 - c. For chemical cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
 - d. For water spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
 - e. For heated water spray application, use equipment capable of maintaining temperature between 140 and 160 deg F at flow rates indicated.
 - f. For steam application, use steam generator capable of delivering live steam at nozzle.
3. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
4. Removing Plant Growth: Completely remove plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil and debris from open masonry joints to whatever depth they occur.
5. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
 - a. Carefully remove heavy accumulations of material from surface of masonry with a sharp chisel. Do not scratch or chip masonry surface.

ITEM 918.100 & ITEM 918.300 (Continued)

- b. Remove paint and calking with alkaline paint remover. Comply with requirements for paint removal. Repeat application up to two times if needed.
- c. Remove asphalt and tar with solvent-type paint remover. Apply only to asphalt and tar by brush without pre-wetting. Allow paint remover to remain on surface for 10 to 30 minutes. Rinse off with water using low-pressure spray. Repeat application if needed.
- 6. Water Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of masonry and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- 7. Steam Wash: Apply steam to masonry surfaces at pressures not exceeding 80 psi. Hold nozzle at least 6 inches from surface of masonry and apply steam in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- 8. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical cleaner manufacturer's written instructions; use brush or spray application methods, at Contractor's option. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.
- 9. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed. Apply neutralizing agent and repeat rinse, if necessary, to produce tested pH of between 6.7 and 7.5.
- 10. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

Cleaning Stonework

- 1. Cold-Water Wash: Use cold water applied by medium-pressure spray.
- 2. Steam Cleaning: Apply steam at pressures not exceeding 80 psi.
- 3. Detergent Cleaning:
 - a. Wet masonry with water applied by low-pressure spray.
 - b. Scrub masonry with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that masonry surface remains wet.
 - c. Rinse with water applied by medium-pressure spray to remove detergent solution and soil.

ITEM 918.100 & ITEM 918.300 (Continued)

- d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
4. Mold, Mildew, and Algae Removal:
 - a. Wet masonry with water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush or low-pressure spray.
 - c. Scrub masonry with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that masonry surface remains wet.
 - d. Rinse with water applied by medium-pressure spray to remove mold, mildew, and algae remover and soil.
 - e. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
5. Nonacidic Gel Chemical Cleaning:
 - a. Wet masonry with water applied by low-pressure spray.
 - b. Apply nonacidic gel cleaner in 1/8-inch thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively so area will be uniformly covered with fresh cleaner and dwell time will be uniform throughout area being cleaned.
 - c. Let cleaner remain on surface for period as established by mockup, As recommended by chemical cleaner manufacturer.
 - d. Remove bulk of nonacidic gel cleaner by squeegeeing into containers for disposal.
 - e. Rinse with water applied by medium-pressure spray to remove chemicals and soil.
 - f. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.
6. Nonacidic Liquid Chemical Cleaning:
 - a. Wet masonry with water applied by low-pressure spray.
 - b. Apply cleaner to masonry in two applications by brush or low-pressure spray. Let cleaner remain on surface for period as established by mockup.
 - c. Rinse with water applied by medium-pressure spray to remove chemicals and soil.
 - d. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam wash.

ITEM 918.100 & ITEM 918.300 (Continued)**Repointing Masonry**

1. Rake out and repoint mortar joints to the following extent:
 - a. All joints in areas indicated and as follows.
 - b. Joints where mortar is missing or where they contain holes.
 - c. Cracked joints where cracks can be penetrated at least 1/4 inch by a knife blade 0.027 inch thick.
 - d. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
 - e. Joints where they sound hollow when tapped by metal object.
 - f. Joints where they are worn back 1/4 inch or more from surface.
 - g. Joints where they are deteriorated to point that mortar can be easily removed by hand.
 - h. Joints, other than those indicated as sealant-filled joints, where they have been filled with substances other than mortar.
2. Do not rake out and repoint joints where not required.
3. Rake out joints as follows:
 - a. Remove mortar from joints to depth of joint width plus 1/8 inch, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
 - b. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 - c. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Engineer. Cut out mortar by hand with chisel and mallet. Do not use power-operated grinders without Engineer's written approval based on submission by Contractor of a satisfactory quality-control program and demonstrated ability of operators to use tools without damaging masonry. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.
4. Notify Engineer of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
5. Point joints as follows:
 - a. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing.
 - b. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

ITEM 918.100 & ITEM 918.300 (Continued)

- c. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing bricks have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.
 - d. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.
6. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours including weekends and holidays.
 - a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
 - b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
 7. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

Final Cleaning

1. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure. Do not use metal scrapers or brushes. Do not use acidic or alkaline cleaners.
2. Wash adjacent woodwork and other nonmasonry surfaces. Use detergent and soft brushes or cloths.
3. Clean masonry debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
4. Sweep and rake adjacent pavement and grounds to remove masonry debris. Where necessary, pressure wash surfaces to remove mortar, dust, dirt, and stains.

Field Quality Control

1. Inspectors: Contractor shall engage qualified independent inspectors to perform inspections and prepare test reports. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
2. Engineer will observe progress and quality of portion of the Work completed. Allow Engineer use of scaffolding, as needed, to observe progress and quality of portion of the Work completed.

ITEM 918.100 & ITEM 918.300 (Continued)

3. Notify Engineer in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Engineer has reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for the work to be done under ITEM 918.100 MASONRY CLEANING shall be at the Contract Unit Price per SQUARE FOOT of stone masonry cleaned and accepted; which price shall include full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work in a manner satisfactory to the Engineer.

Payment for the work to be done under ITEM 918.300 MASONRY REPOINTING shall be at the Contract Unit Price per FOOT of stone masonry repointed and accepted; which price shall include full compensation for all labor, equipment, materials, and tools necessary to accomplish the specified work in a manner satisfactory to the Engineer.

ITEM 950.5**TEMPORARY EARTH SUPPORT SYSTEM****LUMP SUM**

The work to be done under this Item shall conform to the applicable provisions of Sections 140 and 950 of the Standard Specifications, amended as follows:

The Contractor shall furnish, install, maintain, relocate if necessary, and remove a temporary earth support system and all associated other work to be used in the demolition and construction of the abutments and wingwalls. The temporary earth support system shall be designed and constructed as required to allow the safe staged removal of existing structures, and staged construction of proposed structures and shall prevent damage to, or undermining of, the sides of excavations, roadways, driveways, and portions of existing structures to remain and/or be maintained.

The temporary earth support system shall either consist of sheet piling, soldier piling and lagging, or any other system, which is approved by the Engineer. The approximate layout of the temporary earth support system is shown on the Plans. Steel sheeting if used shall conform to ASTM A328. Foreign source of supply may be submitted for approval if sufficient documentation is provided demonstrating that domestic material is unavailable and that ASTM A328 compatibility is achieved.

The design of the temporary excavation support system in Washington Avenue shall conform to industry standards and all OSHA requirements. The Contractor shall determine the final location and design of the excavation support system to protect the adjacent buildings, utilities and structures; to provide necessary clearance for demolition and construction; and to protect the portions of the existing bridge and utilities to remain in service during construction. The support system shall be designed for earth and ground water loads, construction surcharge loads, and adjacent building loads. The support system shall be designed to prevent damage resulting from loss of ground and lateral movement and settlement of the ground and ground surface behind the wall.

Construction of the temporary excavation support system shall be in accordance with the accepted design. The construction materials and methods shall be suitable to meet the building settlement criteria for 63 Washington Avenue and the vibration criteria contained in Special Provision Item 100.9 "Pre and Post Construction Survey, Geotechnical Instrumentation and Monitoring". Equipment, and means and methods for construction of the temporary support system shall maintain adequate clearance from overhead high voltage and other utility lines at all times.

Soldier piles or other vertical elements used for the temporary excavation support system shall be left in place and cut off at a depth of 4 feet below final road grade at the completion of construction. Tiebacks used for lateral support of the temporary excavation support system shall be detensioned and abandoned in place and wales shall be removed when the backfilling has reached an elevation not more than 2 feet below the tieback elevation. Lagging shall be removed in lifts during backfilling when the level of backfilling has reached the bottom of the lagging board.

The Contractor shall make his/her own evaluation of existing site conditions and facilities, and shall design and construct the proposed temporary earth support system to be compatible with the Contractor's means and methods of construction including Bridge Demolition, Bridge Excavation and Bridge Construction.

ITEM 950.5 (Continued)

The temporary earth support system at locations shown on the plans shall be fully designed by the Contractor to carry all the applicable AASHTO loads. It shall be designed in accordance with the AASHTO Guide Design Specifications for Bridge Temporary Works, 1995, and all interims published as of the bid opening date.

The Contractor is responsible for determining all geotechnical criteria associated with the temporary earth support system including, but not limited to, lateral earth pressures, live load surcharge, surcharge due to construction equipment operation, surcharge due to temporary traffic barriers and/or surcharge due to material storage near the top of excavation. Maximum design stresses in steel members shall not exceed 125% of the allowable basic stresses specified in the current specifications of the American Institute of Steel Construction. The design shall provide for all anticipated load conditions that may occur during the entire construction period. The minimum factor of safety for each of the design conditions shall be 1.50.

The temporary earth support system must be designed and stamped by a Professional Structural Engineer registered in the Commonwealth of Massachusetts. Complete detailed drawings and calculations shall be submitted to the Engineer for approval. Written approval must be obtained prior to installation of temporary earth support system. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful project completion.

The temporary earth support system that protrudes into the soil that supports the bridge structure shall be left in place, and no additional payment will be made for the temporary earth support system left in place. Supporting soil shall be defined as all soil directly below the pile cap contained within a series of planes that originate at the perimeter of the bottom of the pile cap and project down and away from the pile cap at an angle of 45 degrees from the horizontal.

BASIS OF PAYMENT

Payment for all work under this Item shall be at the Contract Unit Price per LUMP SUM, which price shall constitute full compensation for the Contractor's design and plans, all material, labor, tools and equipment necessary for the proper completion of the work specified. Partial payment shall be made upon the following percentages: 60% upon complete installation and 40% upon complete removal and acceptance of the completed project by the Engineer.

ITEM 953.3**BRACED STEEL SHEETING****POUND**

The work to be done under this Item shall consist of the furnishing and installing permanent steel sheeting as the excavation support system for the construction of the foundation of the bridge pier, in conformance with Section 950 and the provision included herein. The sheeting shall be braced during construction as indicated on the Plans.

MATERIALS

The materials shall be as follows and as shown on the plans:

Steel Sheet Piles – shall be continuous interlock steel sheet piles conforming to the requirements of Standard Specification M.8.05.4 with continuous interlocks and having the minimum dimension, weight and section properties shown on the plans. Steel sheet piles may be new or use material, provided that used materials shall have no damage, deformation, holes, cutouts, patches or splices.

Steel Wales and Bracing – shall meet the minimum strength, grade, shape, dimensions, weight and section properties shown on the plans. Wales and bracing may be new or used material, provided that used materials shall have no damage, deformation, holes, cutouts, patches or splices.

The permanent sheet piling shall meet the following parameters:

- Minimum section modulus required: $S = 30.2 \text{ in}^3$.
- Highest ground elevation outside sheet piling: El. 7.5
- Lowest ground elevation (bottom of excavation): El. -2.5
- Proposed sheet piling cut-off upon completion of grading: El. 4.8
- Live load (Cooper E80 railroad loading with 50% impact) surcharge is considered

A layout of sheet piling is shown on the Plans for the construction of the bridge pier. The location of the sheet piling may be altered by the Contractor to suit his construction methods upon approval of the Engineer and Railroad and subject to the design parameters stated above. Installation of sheet piling shall be done in conformance with the Railroad requirements and scheduling such that disruption of service is avoided. The field conditions, including hard driving conditions and possible obstructions, may influence the type of sheeting necessary. The Contractor shall make his/her own evaluation of existing site conditions and facilities, and shall modify the proposed system as necessary.

Complete working drawings shall be submitted for the steel sheeting in which are shown all materials, sizes of members, connections, methods and sequence of installation. The working drawings shall be certified by a structural engineer registered in the Commonwealth of Massachusetts. Approval of the working drawing does not relieve the Contractor of the responsibility of providing for the safety of the work and the successful completion of the project.

ITEM 953.3 (Continued)

The steel sheeting shall be installed and maintained in such a manner as to prevent movement, settlement, loss of ground or damage to new and existing structures and the railbed.

Measurement for the steel sheeting will be per pound of sheet piling installed. An alternative to the steel sheeting or the sheeting layout may be proposed by the Contractor and will not be compensated for beyond the amount shown in the Contract Drawings. Bracing is considered incidental to this work and shall not be measured for payment.

Payment for work under this item shall be at the contract unit price per pound of sheet piling complete, in place, and shall include all labor, materials, equipment, transportation, additional site testing, and other incidental work required for the satisfactory completion of work, including the work required for removal of obstruction and for cutting off the top of the sheet piling after final grading. The cost of implementing an alternate to the steel sheeting proposed by the Contractor shall be borne by the Contractor to the extent that measurement of the alternate excavation support systems exceeds the amount shown in the Contract Documents.

ITEM 953.5**SEQUENTIAL PIT UNDERPINNING****LUMP SUM**

Work under this Item shall conform to the relevant provisions of Sections 120, 901, 955, and the following:

GENERAL

The work of this Item shall consist of installing the sequential pit underpinning at the 63 Washington Avenue building as shown on the plans and as specified herein. The Contractor is responsible for furnishing all materials, labor, equipment, tools and supplies necessary for and incidental to the performance of the work, and for selecting the means and methods for the installation of the underpinning.

The work shall include but not be limited to:

1. Verifying location of existing foundations on west building wall determined by measurement of visible foundations on ground floor inside building and elevation of foundations on north building wall at each underpinning pier determined by probes or test pits,
2. Making necessary adjustments to the proposed underpinning layout to adapt to field verified locations of existing footings,
3. Excavating and placing lagging access pits and underpinning pits,
4. Placing concrete for underpinning piers,
5. Installing dry-pack cement grout between the top of the underpinning pier and the bottom of the existing building foundation,
6. Installing and tensioning tiebacks,
7. Installing lagging between underpinning piers during general site excavation, and
8. De-tensioning tiebacks as general site excavation is backfilled,
9. Performing all architectural and structural repairs and restoration for any damage at 63 Washington Avenue and adjacent property caused by the Contractor's operations.

Prior to commencing and at the completion of all work, a pre- and post-construction survey of the 63 Washington Avenue building shall be made. Geotechnical instrumentation and monitoring shall be performed as the work progresses. The pre- and post-construction surveys and all instrumentation and monitoring shall be paid under Item 100.91 Pre and Post Construction Survey, Geotechnical Instrumentation and Monitoring – Site 1.

Repair and restoration of any damage to the building at 63 Washington Avenue caused by the Contractor's operations shall be performed to the satisfaction of the building owner and Engineer, in accordance with Special Provision, Section 7.13 Protection and Restoration of Property.

MATERIALS

Timber Lagging – for access and underpinning pits and between underpinning pits shall be visually graded, 3-inch rough cut thickness, No. 2 southern pine or equal having a minimum bending strength, F_b of 1,050 psi.

ITEM 953.5 (Continued)

Concrete – for filling underpinning pits shall have minimum 4,000 psi compressive strength at 28 days and shall conform to Standard Specification M4.02.00 with 1-1/2-inch aggregate size, 4-inch slump, and Portland Type III high early strength cement.

Dry Pack – shall consist of a commercially manufactured non-shrink grout mix consisting of sand and cement, mixed with water at the time of use, having minimum 24-hour strength of 4,000 psi and specifically intended for grouting column caps, base plates and similar load bearing uses.

Tieback Rods and Hardware – tieback rods shall consist of hollow core high strength steel threaded rod intended for use as soil anchors and tiebacks, as manufactured by Dywidag, SAS Stressteel, or Williams Form, or equal. Rods shall have a minimum outside diameter of 1.5-inches, and shall have a minimum yield strength of 80 kips tension. Couplings and lock-off nuts shall have tensile capacity equal to 100% of the tensile capacity of the rod. Bearing plates shall be a minimum of 10-inches by 10-inches by 1-inch thick, grade A36 steel.

1. Grout for Tiebacks – shall be a mix of Portland cement and potable water, with minimum 24-hour compressive strength of 2,500 psi and minimum 28-day compressive strength of 4,000 psi. The water content of the grout shall be the minimum necessary for proper placement and shall not exceed a water/cement ratio of 0.45 (by weight). Cement shall be Type II Portland Cement conforming to ASTM C-150 specifications. Cement should be fresh and should not contain any lumps or other indications of hydration. Grout additives, including accelerators and expansive agents, may be used only with the approval of the Engineer. Mix and place additives in accordance with the manufacturer's recommendations. The total chloride content of the Portland cement and any additives shall not exceed 0.05% by weight of cement.

These tieback specifications apply only to the tiebacks for the underpinning pits. Tieback design, materials and installation and testing procedures for the temporary excavation support in Washington Avenue shall be determined by the Contractor as required in Section 950.5 Temporary Earth Support System

CONSTRUCTION METHODS

At least six weeks prior to start of underpinning construction, Contractor shall submit the following information for the materials and procedures he intends to use in the work:

1. Certification letter indicating source, grading information, and strength test results for timber lagging.
2. Concrete supplier, mix design and strength test results.
3. Dry-pack material source, type and manufacturer's test data and installation instructions.
4. Tieback rod and hardware type and manufacturer's documentation of material properties.

ITEM 953.5 (Continued)

5. Source and type of cement for tieback grout.
6. Mix design and compressive strength test results for tieback grout, including manufacturer's literature for any proposed additives.
7. Drawing showing a) location of existing foundations on west building wall determined by measurement of visible foundations on ground floor inside building, b) elevation of foundations on north building wall at each underpinning pier determined by probes or test pits, and c) identifying any adjustment to underpinning pier locations required to accommodate existing foundation conditions.
8. Means and methods to construct access pits and underpinning pits, including calculations prepared and stamped by a professional engineer registered in Massachusetts for any proposed changes from the underpinning design shown on the plans.

Construction of the underpinning shall not commence until the submittals for materials and procedures have been accepted.

Access and underpinning pits shall be installed sequentially in the order and in accordance with the requirements shown on the plans.

Excavation in the access and underpinning pits shall not proceed to a depth more than 2-inches plus the width of the lagging board below the last installed lagging board. Excavation of pit walls shall be performed with flat-bladed shovel to create a smooth face aligned with the back of the lagging board. Any void in back of each lagging board shall be backfilled with soil. The vertical space between lagging boards shall be no more than $\frac{3}{4}$ -inch, and shall be back-packed with geotextile fabric and/or sand.

Contractor shall slightly slope bottom of excavation toward a sump and shall provide and operate pumps to remove water from any source, including ground water and precipitation, that accumulates in the bottom of the pit. The design bearing elevation of the underpinning piers is at or below the ground water elevation.

Lagging shall be installed for the full depth of the pit so that concrete for underpinning pier does not extend beyond face of existing building foundation.

A minimum 3-inch thick mudmat of 4,000 psi minimum compressive strength concrete shall be placed on the bottom of the pit immediately after completion of excavation, placement of lagging and thorough cleaning of the pit bottom at each pit, and after the bottom of the pit has been observed and approved by the Engineer. The Contractor may use $\frac{1}{2}$ -inch crushed stone in lieu of the mudmat if approved by the Engineer after observation of the cleaned underpinning pit bottom.

Each pit shall be backfilled with concrete as soon as practical after the excavation reaches the bottom elevation of the pit. Block-outs in the concrete shall be provided for each tieback bearing plate at the location shown on the plans. Contractor shall either install a pipe sleeve for the tieback through the concrete, or shall core through the concrete for the tieback.

ITEM 953.5 (Continued)

Top of concrete shall be at least 2-inch and no more than 3-inches below bottom of existing footing. Space between top of concrete and bottom of footing shall be dry-packed within 24-hours after concrete has achieved compressive strength of at least 4,000 psi. Dry-pack material shall be mixed to a stiff consistency and placed in accordance with manufacturer's recommendations, to completely fill the void space. The gap is to be fully filled by ramming the dry-pack material into place with a wooden post or pneumatic tamper. Vertical movement of the building shall be monitored continuously during placement of the dry-pack material. Dry-packing shall be controlled so that no more than 1/4-inch of heave occurs.

General site excavation in the within 20 feet of the 63 Washington Avenue building shall not proceed more than 2 feet below the design underpinning pier tieback elevation until the tieback has been installed, tested and locked off at the design load.

Tiebacks shall be drilled with a sacrificial drill point on the hollow threaded tieback rod, to the depth and alignment shown on the plans. The drilling shall be performed for the entire length with grout as the drilling fluid to prevent loss of ground during drilling and to ensure complete filling of the void space around the tieback rod. Upon completion of drilling, the bond breaker sleeve shall be installed to the depth shown on the plans. Contractor shall make a minimum of six (6) grout strength cubes for each tieback.

Any proposed deviations from the specified tieback materials and installation procedure must be submitted to the Engineer in advance with sufficient data to demonstrate that the proposed materials and procedures are equal or better than the specified methods. No deviations will be allowed unless approved by the Engineer.

The tieback shall be proof-tested to a minimum load of 133% of the design load, using procedures in accordance with Post Tensioning Institute document "Recommendations for Prestressed Rock and Soil Anchors (2004)". Proof testing shall not be performed within 72 hours after tieback installation, and until the grout has achieved a compressive strength of at least 3,000 psi as verified by testing of two (2) grout cubes. Upon satisfactory completion of proof testing, the tieback shall be locked off at a load equal to 100% of the design load.

In the event that a tieback does not meet the proof test requirements, the Contractor shall install an additional tieback through that underpinning pier at no additional cost.

Upon completion of adjacent bridge construction, and during backfill of the construction work area, the tiebacks shall be de-tensioned and abandoned in place when the backfill reaches a level of 1 foot below the tieback elevation.

Timber lagging shall be removed during access pit and general site backfilling wherever practical.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Sequential pit underpinning as shown on the drawings shall be paid for at the contract LUMP SUM price. Payment for this item shall be full compensation for all labor, materials, equipment, tools and supplies necessary for completion of the work.

ITEM 975.61
ITEM 975.62**ORNAMENTAL FENCING TYPE I**
ORNAMENTAL FENCING TYPE II**FOOT**
FOOT

Ornamental fencing, furnished and installed for use in this project shall conform to the relevant provisions of Section 960 and the following:

GENERAL

The work under these items shall consist of furnishing and installing ornamental fencing at locations indicated and detailed on the Plans, and as per following specification. The work will be performed in accordance with the requirements of the AASHTO Standard Specifications for Highway Bridges, the Bridge Welding Code (ANSI/AASHTO/AWS D1.5) and these Special Provisions.

MATERIALS**Ornamental Fencing Type I**

Materials for the Type I Fencing to be installed at and adjacent to the BRT Stations shall conform the MBTA Supplemental Specifications included in Document A00803 - Appendix A, and as shown on the Drawings.

Ornamental Fencing Type II

All steel for main support posts, railing bars, base plates, anchor plates, attachment bars, and railing circles shall conform to the requirements of AASHTO M270 Grade 36 (ASTM A709 Grade 36) shall be hot-dip galvanized in accordance with ASTM A123.

Steel Pipe for Guardrails shall conform to ASTM A500 Schedule 80 (Extra Strong), galvanized and supplied with end caps.

All Steel for railing and all attachments shall be hot-dip galvanized in accordance with the requirements of AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight).

All welding shall conform to latest edition of the AASHTO/AWS Bridge Welding Code (ANSI/AASHTO/AWS D1.5) and all interim revisions published by AASHTO as of the bid opening date.

Paints shall conform to the requirements of Section M7 and the following:

Epoxy Urethane coating system of an epoxy intermediate coat with an aliphatic urethane finish coat shall be selected from: Valspar, Ameron, Caboline, Koppers, or an approved equal.

Color of finish coat to be black (semi-gloss).

ITEM 975.61 & ITEM 975.62 (Continued)**CONSTRUCTION METHODS****Ornamental Fencing Type I**

Type I Fencing shall be installed in accordance with the MBTA Supplemental Specifications included in Document A00803 - Appendix A, and as shown on the Drawings.

The Contractor shall submit shop drawings of the Type I fencing with metal fabric for approval by the Engineer.

Ornamental Fencing Type II

The Contractor shall submit shop drawings of the Type II fencing for approval by the Engineer.

The railing main support posts shall be installed such that they rise within a tolerance of one-half (0.5) degree from the vertical.

The railings shall be delivered to the site shop assembled in two components. The main support posts shall be delivered as one unit galvanized and painted, and shall consist of; railing main posts, main post base plate, guardrail sleeve, and attachment bars as shown on the plans. The railing panels shall be delivered as one unit galvanized and painted, and shall consist of; bottom railing bar, intermediate railing bar, top railing bar, guardrail, woven wire fabric, railing circles (11), and railing bars (13) as shown on the plans.

All railing steel shall be hot-dip galvanized having a minimum dry film thickness of 3 mils (0.003 in).

All railing steel shall receive one full shop applied intermediate coat of epoxy and one full shop applied finish coat of aliphatic urethane, unless otherwise noted. Each coat shall have a dry film thickness of 5 to 8 mils (0.005 inches to 0.008 inches). Color of the finish to be black.

The paint shall be applied with satisfactory airless spray machines in accordance with the paint manufacturer's instructions and the applicable provisions of SSPC-PA-1.

Any damage to the paint system during shipment or handling shall be repaired as per the paint manufacturer's recommendations.

The Contractor shall submit the selected manufacturer's technical data sheets, safety data, specific application instructions, and recommended procedures for all coats for approval by the Engineer.

The Contractor shall provide the services of a painter or painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Painting procedures shall be in accordance with the applicable requirements for Subsection 960.63, Painting, the paint manufacturer's recommendations and conforming to ASTM D6386-99.

ITEM 975.61 & ITEM 975.62 (Continued)

All coatings shall be in compliance with 310 CMR Section 7.0 and 7.18 of the Massachusetts Air Pollution Control Regulations.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work under this item will be measured and paid for at the contract unit price per FOOT of ornamental pedestrian railing (Type 1 and Type 2), complete in place. The price shall include all materials, labor, tools and equipment incidental and necessary for the installation, complete in place.

ITEM 991.1 **CONTROL OF WATER – STRUCTURE NO. C-09-001** **LUMP SUM**

The work under this Item shall conform to the relevant provisions of Subsection 140.60, amended and/or supplemented as follows:

The work to be done under this Item shall consist of all work required for the control of water and siltation, if necessary, to ensure that all concrete comprising the bridge substructure and foundations are placed and cured in the dry as shown on the plans, or as directed by the Engineer. The work shall include all incidental dewatering, pumping, sandbagging, filtration or dewatering basins, or other measures inclusive of sheeting, necessary for sufficient water control to accomplish the construction of the proposed substructure and foundations in the dry.

The Contractor shall submit complete working drawings and computations of his proposed dewatering scheme to the Engineer for approval in accordance with Subsection 5.02 and these Special Provisions. A Professional Engineer registered in the Commonwealth of Massachusetts shall certify both. The furnishing of such schemes shall not serve to relieve the Contractor of any of his responsibility for the safety of the work or the responsibility for the successful completion of the project.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of transporting by water any part of the concrete materials being placed. No such pumping will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it is done by a method approved by the Engineer. During dewatering operations, water that is pumped from the interior of any foundation enclosure shall be conveyed into a sedimentation basin or other device or methodology which will cleanse the water before being discharged away from the site. After the removal of systems the site locations shall be restored to their original condition.

The Engineer shall make partial payments in proportion as the foundation work progresses with the final 10 percent (10%) shall be paid upon the satisfactory removal of the entire Water Control System from the site after it is no longer required and site restoration to its original condition.

BASIS OF PAYMENT

Under ITEM No. 991.1 of the Contract, the Contractor will be paid the Contract LUMP SUM price for Control of Water, which price shall include full compensation for the design of the water control schemes, all equipment, materials, tools and labor necessary for the installation, maintenance, removal and disposal of the materials used for water control including all cost associated with obtaining the necessary permits.

ITEM 994.01**TEMPORARY PROTECTIVE SHIELDING**
BRIDGE NO. C-09-001**LUMP SUM**

The work under this Item shall consist of designing, furnishing, installing, maintaining, removing and disposing of temporary protective shielding system. The shielding shall protect the surrounding areas, including all personnel and/or pedestrians below the bridge, from falling or flying debris during demolition and construction operations. The shielding shall prevent any debris, tools, or incidental items from falling onto areas where pedestrian traffic exists. The shielding shall also serve as a work platform for the personnel performing the demolition and construction operations, as well as any equipment required.

Prior to the start of demolition, the Contractor shall be required to submit the details of the temporary shielding to the Engineer for review and approval. The plans will be reviewed as to the methods of erection and as to whether or not the proposed installation will provide the required level of protection. It is the Contractor's responsibility to design the protection shielding to conform to all Federal, State and Local laws and regulations and the requirements contained in the Contract Documents. The protection shielding shall be designed by a Professional Structural Engineer registered in the Commonwealth of Massachusetts. The drawings and calculations shall bear his/her seal when they are submitted to the Engineer. Written approval must be obtained prior to erection of the protection shielding.

The shielding shall be designed to safely withstand all loads that it will be subjected to. The allowable design stresses shall be in accordance with AASHTO Standard Specifications for Highway Bridges. The design of the shielding for deck removal shall also include a complete description of the equipment and construction methods proposed for the deck removal and also the maximum size of deck area being excavated. The shielding shall also be designed to withstand the maximum size of deck area excavated should it fall inadvertently.

The shielding shall extend the full length of the bridge span and a sufficient distance above and beyond the deck overhang at the fascia to protect the roadway below. All spaces along the perimeter of the shielding and at the seams shall be sealed to prevent dust and debris from escaping and falling onto roadway below. Containment measures shall conform to section 961.67 of the MassDOT Standard Specifications (June 15, 2012 Supplemental Specifications).

Shielding shall be removed only upon approval of the Engineer. After completion, the shielding shall be removed and disposed of properly. All materials used in the shielding system shall be property of the Contractor and shall be completely removed from the site at the completion of the project.

BASIS OF PAYMENT

Under ITEM 994.01 of the Contract, the Contractor will be paid the Contract LUMP SUM price for Temporary Protective Shielding, which price shall include full compensation for the design of the shielding scheme, all equipment, materials, tools and labor necessary for the installation, maintenance, operation, removal and disposal of the protective shielding. Payment of 75% of the LUMP SUM Contract Price of this Item will be paid upon complete installation and approval by the Engineer. The remaining 25% of the Lump Sum Price of this Item will be paid following complete removal and disposal of the shielding from the project.

ITEM 995.01**BRIDGE STRUCTURE, BRIDGE NO. C-09-001****LUMP SUM**

The work to be done under this Item shall conform to the relevant provisions of Section 995, and with the specific requirements stipulated below for component parts of the subject items. Where no specific requirement is directed for a component part of the construction of Item 995.01, the Standard Specifications shall apply, except for payment.

The work under this Item consists of the construction of the bridge structure including all material, equipment and labor necessary to construct and/or install the following:

- Cast-in-place concrete footings, abutments and wingwall stems, pier stems, abutment cap, deck slab, approach slabs, closure pours, sidewalks, and moment slabs and all the steel reinforcement for these items;
- Steel rolled beams, shear connectors, laminated elastomeric bearings, and protective screen;
- All items included hereinafter under Basis for Partial Payments.

The LUMP SUM payment for work on the Bridge Structure listed above does not include payment for the demolition of the bridge, various classes of excavation and fill, temporary earth support system, sequential pit underpinning, braced steel sheeting, control of water, temporary shielding, and other items as listed elsewhere in the Proposal.

4000 psi, 1 ½", 565 CEMENT CONCRETE

4000 psi, ¾", 610 CEMENT CONCRETE

5000 psi, ¾", 685 HP CEMENT CONCRETE

4000 psi, ¾", 585 HP CEMENT CONCRETE

The work to be done under these headings shall conform to the relevant provisions of Section 901, supplemented and amended as follows:

All concrete shall be placed in the dry.

The various classes of concrete shall be used as specified on the Plans, and generally described as follows:

4000 psi, 1 ½", 565 cement concrete shall be used to construct the abutment and wingwall footings and stems, pier footing, approach slab, highway guard rail transition base and moment slab.

4000 psi, ¾", 610 cement concrete shall be used to construct the abutment backwall and closure wall, and pier stem and cap.

5000 psi, ¾", 685 HP cement concrete shall be used to construct the sidewalks, CP-PL2 Barrier and highway guard rail transition.

4000 psi, ¾", 585 HP cement concrete shall be used to construct the deck slab, deck slab closure pours and end diaphragm.

ITEM 995.01 (Continued)

Included in the work are the furnishing and installing of preformed fillers and other items incidental to the furnishing and placing of concrete. All other work covered in the Schedule of Basis for Partial Payments or for which payment is not provided elsewhere in the contract shall be considered as included in the unit price per cubic yard of concrete, as stated by the Contractor and approved by the Engineer, in the respective "Basis for Partial Payment".

4000 PSI, 3/4 IN., 585 HP CEMENT CONCRETE

The work to be done under this heading shall conform to the relevant provisions of Subsection 901 of the Supplemental Specifications and the following:

4000 PSI, 3/4 IN., 585 HP Cement Concrete shall be used to construct the deck slab, deck slab closure pours and end diaphragm and at those areas designated by the Engineer, and/or as designated on the Plans.

4000 psi, 3/4 in., 585 HP Cement Concrete shall conform to all material requirements contained in Subsection M4.06.1 of the Supplemental Specifications, with the exception of cementitious content, which shall be limited to a maximum of 585 pounds per cubic yard.

At least 30 calendars days prior to the proposed start of placing the concrete bridge deck, the Contractor shall submit to the Engineer for approval, a submission (herein called the Placement and Curing Plan) specifying the method of concrete conveyance, placement, type and number of finishing machines and work bridges, rate of pour, estimated time of completion, screed and rail erection plan, sequence of concrete pours, and the concrete curing procedure. The Placement and Curing Plan shall take into consideration weather conditions. It shall also include details and a complete description of equipment to be used in the handling, placement, finishing and curing the concrete including the number and type of personnel who will be engaged in the operation. The personnel shall consist exclusively of persons with the experience and skill appropriate to their working assignment. Approval of this plan will not relieve the Contractor of the responsibility for the satisfactory performance of his/her methods and equipment. The Placement and Curing Plan shall include, but not be limited to, the following:

1. Proof of the following minimum operator qualifications for the bridge deck finishing machines(s):
 - a. Five years experience operating machines of similar type and manufacturing as that proposed.
 - b. Proof of no less than five bridge decks of similar size, placed using a machine of the same manufacturer as that proposed.
- Or, as a substitute for a. and b.:
- c. A representative of the manufacturer of the bridge deck finishing machine shall be present on the site a minimum of 24 hours in advance of the proposed deck placement to approve the set up of the machine and rail system, and the representative shall be present for the entire duration of the placement of the deck concrete using the bridge deck finishing machine.

ITEM 995.01 (Continued)

2. Provisions for the consolidation of cement concrete. At least one vibrator shall be in service per each 30 cubic yards per hour of cement concrete placed with at least 2 vibrators in service at all times.
3. Curing method. At least two workers shall continuously place wet burlap curing materials from a dedicated work bridge from the start of the deck placement until the deck is completely covered with wet burlap.
4. When cold weather is reasonably expected during the required wet curing period, or has occurred within 7 days of anticipated concrete placement, the Contractor shall include detailed procedures for the production, transporting, placing, provisions for enclosures, protecting, curing, and temperature monitoring of concrete during cold weather, including a plan of heating devices, types and locations around structure.
5. Method of monitoring temperature of hardened concrete. The method of monitoring concrete temperatures shall be submitted regardless of whether cold weather is expected during the 14 day wet cure period.
6. Letter certifying that the fogging equipment attached to the finishing machine produces atomized water droplets with an average droplet diameter of 0.003 inches or less that are uniformly distributed at a rate of at least 0.10 gallons/square foot/hour.
7. Backup systems as required.

Before concrete placement operations begin, the Contractor shall make all necessary arrangements and have all materials on hand for curing and protecting the concrete deck. Concrete placement shall not proceed until the Engineer is satisfied that all necessary steps have been taken to insure adequate compliance with these Specifications and that completion of the operation can be accomplished within the required scheduled time. It shall be the Contractor's responsibility to allow sufficient time to permit such an inspection by the Engineer.

A pre-placement meeting shall be held between the Contractor and the Engineer at least 2 weeks prior to the start of any concrete placement for the deck slab. The Contractor and the Engineer shall review all aspects of the proposed deck slab concrete placement, as documented in the approved Placement and Curing Plan, including, but not limited to, the following:

- Equipment proposed for use and for back-up;
- Planned workforce and assigned tasks of each designated position, based on experience and expertise;
- Proposed construction techniques;
- Safety considerations;
- Concrete mix design;
- Admixtures and performance data; dosage rates shall be as approved;
- Proposed placement rate, provisions for adverse weather, curing and loading schedules;
- Curing Practices to be employed as well as the workforce designated to the curing process;
- Delivery/conveyance equipment, including deck finishing machine setup and operation;
- Traffic control.

ITEM 995.01 (Continued)

No concrete shall be placed until the Engineer approves all aspects of the proposed placement. Modifications must be submitted in writing to the Engineer for approval. No concrete shall be placed until the environmental conditions are deemed favorable and satisfactory means to mitigate adverse environmental conditions exist. Favorable environmental conditions are defined as an expected weather forecast suitable for concrete placement during the entire placement duration with an evaporation rate not to exceed 0.15 lbs./ft²/hr, or suitable equipment and appropriate actions are taken, as approved by the Engineer, to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft²/hr and acceptable curing temperatures are expected for the duration of the curing period.

The Contractor shall provide any necessary means to mitigate adverse weather conditions and curing temperatures with the approval of the Engineer. Failure to maintain acceptable environmental conditions will result in the concrete placement being stopped and a bulkhead put in place. Concrete temperature will be taken from the same sample used for slump and air content tests. These measurements will be taken prior to commencement of concrete placement. If, in the Engineer's opinion, significant changes occur in atmospheric conditions, additional atmospheric measurements and calculations by the Contractor will be required. The Contractor will supply all instruments necessary to make the required calculations, will perform the tests in the presence of the Engineer, and will document the results on the attached "Bridge Deck Placement Environment" table which shall be given to the Engineer for approval and incorporation in the contract documents files.

A trial placement of at least 3 cubic yards using the approved HP Cement Concrete mix design shall be required a minimum of two weeks before the intended date of the deck slab placement. The Contractor will be required to demonstrate proper mix design, batching, placement, finishing and curing of the HP Cement Concrete deck slab. The trial placement shall simulate the actual job conditions in all respects including plant conditions, transit equipment, travel conditions, admixtures, forming, placement equipment, and personnel. If there are problems, the Engineer may require the Contractor to conduct more trial batches and trial placements. Removal of the trial placement concrete from the job site is the responsibility of the Contractor.

In addition to the requirements contained herein, all weather and concrete temperature requirements contained in Subsection 901.64 shall be satisfied. Cement concrete for bridge decks shall not be placed when the ambient air temperature exceeds 85°F or is expected to exceed 85°F during the placement of the deck. When placing concrete, the Contractor must provide suitable equipment and take appropriate actions as approved by the Engineer to limit the evaporation rate of the exposed concrete surface to less than 0.15 lb/ft²/hr. The deck surface evaporation rate shall be determined in accordance with Figure 1 of these Specifications (obtained from "Plastic Cracking of Concrete" by Delmar Bloem for the National Ready Mixed Concrete Association and published in ACI 305R-89) and all data contained in the Bridge Deck Placement Environment table below shall be determined by the Contractor and agreed upon by the Engineer prior to and after casting the bridge deck. To maintain the deck surface evaporation rate below 0.15 lb/ft²/hr the Contractor shall take one or more of the following actions:

ITEM 995.01 (Continued)

1. Misting the surface of the concrete with pressurized equipment attached to the finishing machine until the curing cover is applied. The water mist shall be distributed at a rate of at least 0.10 gallons/square foot/hour. For example, on a deck that is 30 feet wide, the system must be able to apply at least 3.0 gallons of water per linear foot per hour. The fog spray must be produced from nozzles that produce an atomized fog mist that will maintain a sheen of moisture on the concrete surface without ponding. The atomized water droplets shall have an average droplet diameter of 0.003 inches or less. The area of coverage from each nozzle shall overlap all adjacent coverage areas by at least 12 inches. Water that drips from the nozzles shall not be allowed to fall onto the concrete that is being cured.
2. Reduce the temperature of the concrete.
3. Reschedule the placement until such time as the environmental conditions are acceptable, such as at night or during early morning hours.

Bridge Deck Placement Environment						
City/Town:				Date:		
Bridge Number:				Contract Number:		
Start Station:				End Station:		
X	Time Measured	Air Temp.	Relative Humidity (%)	Concrete Temp.	Wind Velocity	Evaporation Rate
Prior to Casting						
After Casting						
Signature - Contractor's Authorized Representative:				Printed Name:		
Signature – MASSDOT Resident Engineer:				Printed Name:		

CEMENT CONCRETE CRACK SEALING

Cement Concrete crack sealing requirements defined herein are for the repair and sealing of cast-in-place cement concrete to prevent water infiltration to the steel reinforcement bars. The width of cracks shall be determined by the Engineer using a width indicating comparator card made of clear plastic with lines of specified width on the cards. The crack width comparator cards shall be held on concrete surfaces to allow the widths of any concrete cracks to be determined by direct visual comparison of the crack width with the widths of the lines marked on the card surface. These cracks are assumed to be non-moving and to have been caused by inadequate control of shrinkage or temperature stresses during curing. Cracks that are of structural concern shall be repaired by other methods determined by the Engineer. All required crack sealing and crack repairs shall be performed by the Contractor without additional compensation. The Contractor shall be required to seal cracks even if the environmental conditions during placement and curing satisfied specification requirements.

ITEM 995.01 (Continued)

Cracks shall be sealed after construction movement is substantially stable and before waterproofing, pavement, or other construction covers the cracked surface. Crack sealing material shall be applied by skilled applicators under a supervisor with proven successful experience in applications with similar scope of work. Crack sealing materials shall be applied when the concrete and the ambient air temperatures are above 40°F. If a heated enclosure is used to accomplish this, the heating units shall be properly vented to the outside of the enclosure to prevent products of combustion from exhausting within the enclosure.

Before containers of sealing materials are opened, the labels shall be checked and the label information shall be documented. If multi-component systems are used, mixing shall be completed prior to application. Manufacturer's instructions shall be followed. An initial crack sealing demonstration application shall be satisfactorily made in the presence of the Engineer before the application is continued.

Before sealing, the concrete must be clean, sound, and free of contaminants and surface moisture. Any curing compounds, sealers, oils, greases, coatings, or other impregnations shall be removed by abrasive blast cleaning. Once any concrete surface contaminants are removed, the concrete shall be swept clean and blown off using oil-free compressed air immediately prior to applying the sealer.

Methacrylate crack sealing shall be performed in accordance with the manufacturer's instruction within the allowable ambient temperature range. The cracks shall be v-notched to a minimum depth of ½" and shall be cleaned with oil-free compressed air. The notch shall then be inspected to confirm that the crack was intercepted. If the crack was not intercepted, the notch shall be expanded to intercept the crack and shall then be re-cleaned with oil free compressed air. Methacrylate shall then be poured into the crack. The crack shall then be observed for seepage of methacrylate and shall be refilled as necessary to ensure the crack is completely filled. If large quantities of methacrylate are used and the crack is not getting filled, the crack should be filled with pre-bagged dried silica sand filler and the crack shall then be re-filled with methacrylate.

Methacrylate crack sealer shall consist of a high molecular weight low viscosity methacrylate monomer that when catalyzed will produce a crack-healer/penetrating-sealer that is a rapid-curing, modified-methacrylate resin. The methacrylate material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Viscosity	<25 cps	ASTM D2393-86
Bond Strength	>1500 psi	ASTM C882
Tensile Elongation	>3%	ASTM D638

ITEM 995.01 (Continued)

In addition, the Methacrylate material shall demonstrate full penetration of concrete cracks in mock-up testing. Mock-up testing shall consist of preparing the deck surface, applying the methacrylate sealer, and removing cores to evaluate the depth and quality of methacrylate sealer penetration. Successful methacrylate penetration of the concrete cracks shall be demonstrated visually in nominal 3 inch deep cores that intersect crack widths in the 7 – 20 mil width range. The cores shall be sliced longitudinally, perpendicular to the crack, and examined in an AASHTO accredited laboratory using ultraviolet light in order to fluoresce the methacrylate to determine the methacrylate penetration depth (the deepest point to which the methacrylate reached) and the sealer-filled crack depth (the depth to which the crack was filled wall-to-wall). The results of mock-up testing shall be documented in a report prepared by the AASHTO accredited laboratory.

Epoxy injection crack sealing shall be performed in accordance with the manufacturer's instructions within the allowable ambient temperature range. Epoxy-Resin for Cement Concrete Crack Injection shall conform to AASHTO M235, Type IV, Grade I. The cracks shall be cleaned with compressed air. Surface mounted injection ports shall then be installed over the centers of the cracks. The spacing of these ports shall be contingent upon the material and the injection equipment chosen. Socket porting shall be allowed provided that a hollow drill bit and vacuum system is used to prevent debris from entering the cracks. Surface ports shall be mounted with rapid setting epoxy material. The crack widths shall be noted during port installation. After the ports are installed, the crack surfaces shall be sealed with high modulus, 100% solids, moisture tolerant epoxy paste adhesive. This material shall be capped with fine sand before it is cured. After the capping material has cured, the cracks shall be injected with an epoxy resin compound. The injection pressure used to seal the cracks shall be based upon a number of factors including crack width, crack depth, and the epoxy material used. Injection shall be accomplished using a metered system. The system shall be equipped with a pressure gauge accurate for the pressures anticipated for this work. Injection shall start at the widest point of the crack and shall continue until the narrowest portions of the crack have been filled. Injection shall continue until refusal. If epoxy is observed at adjacent ports, the adjacent port shall be capped and injection shall continue until refusal occurs. Once refusal occurs, injection shall continue at the next wet port until refusal is reached.

Silane Crack Sealer shall consist of a clear, breathable, high-performance, 100 percent solids by weight Silane sealer for protecting new and existing concrete surfaces. It must penetrate deeply, sealing out water, chloride ions, and acids, and prevent damage from freeze/thaw cycles. Silane Crack Sealer material shall, as a minimum, provide the following as applied properties:

Property	Value	Test
Water Weight Gain at 250 ft ² /gal	88 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft ² /gal	89 percent reduction	NCHRP 244 Series II-Cube test
Absorbed Chloride at 250 ft ² /gal	94 percent reduction	NCHRP 244 Series IV – Northern Climate

ITEM 995.01 (Continued)

The type of Cement Concrete crack sealing required shall be determined as a function of the surface type and maximum crack width as follows:

Bridge decks, either with membrane waterproofing and hot mix asphalt wearing surface or left exposed, and other non-overhead surfaces sloped less than or equal to 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.012" wide shall be sealed with an approved methacrylate;
- Cracks greater than or equal to 0.012" wide shall be sealed using either epoxy injection or methacrylate with a sand filler.

Overhead surfaces, vertical surfaces, and non-overhead surfaces sloped greater than 15%:

- Cracks less than 0.006" wide shall be ignored;
- Cracks greater than or equal to 0.006" wide and less than 0.016" wide shall be sealed with an approved silane sealer;
- Cracks greater than or equal to 0.016" wide shall be sealed using epoxy injection.

CEMENT CONCRETE FORMLINER (INSET ARCHITECTURAL)

The work under this heading shall conform to relevant provisions of Section 901 and as follows:

This work shall consist of furnishing, installing and removing concrete form liners that will be used to produce a simulated stone facing on the exposed faces of the cast-in-place abutments, wingwalls, and piers as shown on the plans, as directed by the Engineer and in accordance with the plans and these specifications.

All formlined concrete surfaces shall be stained to match adjacent existing stone masonry surfaces. See photographs below for reference:



The above photographs are for reference only. The Contractor shall do his/her own investigation and take the necessary field measurements to match the adjacent existing masonry stone size, texture and color.

ITEM 995.01 (Continued)**Materials:**

The concrete form liners shall be as manufactured by one of the following:

1. Custom Rock Form Liner, by Custom Rock International, Inc., St. Paul, MN 55116
2. Fitzgerald Form Liner, 1341 East Pomona Street, Santa Ana, CA 92705
3. SpecFormliners, Inc., 530 East Dyer Road, Santa Ana, CA 92707
4. Symons, by Dayton Superior, Symons, 1125 Byers Road, Miamisburg, OH: 45342

The form liners shall be made of high-strength urethane and not compress more than 3/16" when concrete is poured at a rate of 10 vertical feet per hour. All form liners for the project shall be from a single supplier.

The release agent shall be compatible with the form liners, simulated stone masonry and with the color stain system, as recommended by the manufacturer.

The form ties shall be designed to separate at least 1 inch back from the finished surface, leaving only a neat hole that can be plugged with patching material. Patching material shall be Portland Cement Mortar (Class S).

Staining shall be done by special penetrating stain mix as provided by the manufacturer. The stain mix shall achieve color variations present in the natural stone being simulated by the pattern selected for the project. The stain shall create a surface finish that is breathable (allowing water vapor transmission), and that resists deterioration from water, alkali, fungi, sunlight or weathering. The stain shall be a water borne, low V.O.C. material less than 180 grams/liter, and shall meet the requirements of weathering resistance – 2000 hours accelerated exposure in accordance with the 3-bulb test of ASTM G23, scrub test – 100 revolutions, abrasion resistance (Tabor CF-10) – 500 cycles, adhesion – 1.00 mm cross cuts on glass pass 3 or higher on a scale of 1 to 5 in accordance with ASTM D3359, chemical resistance – ASTM D1308.

Construction Methods

The manufacturer of the simulated stone form liners and custom coloring systems shall demonstrate at least three (3) years of experience making custom simulated stone form liners and color stains to create formed concrete surfaces to match natural stone shapes, surface textures and colors. Evidence and color pictures of projects actually constructed over the last three years shall be submitted prior to approval.

The Contractor or subcontractor who is to install the form liners and perform the work shall demonstrate at least three (3) years of experience placing vertically formed architectural concrete, including training in the manufacturer's special techniques as may be required in achieving realistic surfaces.

An authorized representative from both the form liner manufacturer and the color stain manufacturer shall be present at the site for installation of the facing test panel and during the placing of all structural concrete utilizing form liners.

ITEM 995.01 (Continued)

Prior to initiating any work, a meeting shall be scheduled by the Contractor to assure full understanding of the work by all parties involved to coordinate the work. Included for attendance shall be the manufacturer's authorized representatives, the Contractor, the subcontractor (installer), and the Engineer.

The Contractor shall submit the following for approval by the Engineer prior to beginning the forming operations:

Photographs – Color photographs of at least three (3) similar projects recently performed by the Contractor (or his/her subcontractor) and at least three (3) similar projects recently produced by the manufacturer.

Form Tie Sample – A sample, description and demonstration of the form tie the Contractor proposes to use.

Layout Plans (3 copies) – Layout plans shall be the plan, elevation and details showing the overall pattern, joint locations, form tie locations, weephole locations and any other special conditions.

Concrete Facing Test Panel – At least 30 days prior to placing structural concrete requiring form liners, a concrete test panel is to be built on site, using the same materials and methods of work force that will be used for the project. The Engineer shall approve the location of the test panel. The concrete test panel shall conform to the following:

1. The size of the test panel shall be 50 square feet, or larger if needed to adequately illustrate the pattern selected.
2. The test panel shall contain an area demonstrating the continuation of the pattern through an expansion joint.
3. The test panel shall include staining as may be required for the selected pattern.
4. The test panel shall be removed when it is no longer needed, to the satisfaction of the Engineer.

When form liner is used on adjacent faces at wall corners, the stone coursing (horizontal relief) lines shall be aligned across the corner on both faces. The first vertical relief lines from the wall corner on each face of each course shall be placed such that it gives the appearance of full stones being placed at the corners.

After the form liners are removed, all honeycombed areas and tie holes shall be filled and textured to match the surrounding areas. Seam lines and other unnatural protrusions shall be ground down to match adjacent areas with a hand-held power grinder using disks made for concrete. Patching of tie holes and honeycombed areas and grinding of seams shall be performed immediately after removal of the form liners. The process of wall patching shall be to the satisfaction of the Engineer and conform to Section 901.

ITEM 995.01 (Continued)

All color staining shall be performed by the manufacturer, or his/her authorized representative, and the hardened concrete shall be a minimum of 30 days old before color staining is applied. The Contractor shall power wash the wall to free it from laitance, dirt, oil and other objectionable materials. After the wall has dried, the color staining process is applied using colors approved by the Engineer. Color staining shall be applied in such a way that the stones shall have individual colorations from one to the other. Water-based stains shall be used in air temperatures ranging from 50 degrees F to 100 degrees F. Solvent-based stains shall be used in air temperatures of 50 degrees F and below, but in no case when the temperature of the hardened concrete is 40 degree and falling.

All staining work shall be scheduled after adjacent earthwork is completed to avoid contamination or damaging the surface. Topsoil, riprap, backfill, etc. shall be placed after staining is complete and approved.

STEEL REINFORCEMENT FOR STRUCTURES - EPOXY COATED

The work under this heading shall conform to relevant provisions of Section 901 and as follows:

All steel reinforcement shall be coated. Reinforcing lap lengths shall be as indicated on the plans.

Special procedures shall be used during handling, storage, and installation to prevent damaging epoxy coating, as outlined in the Concrete Reinforcing Steel Institute (CRSI) Engineering Data Report No. 19. Any damage to the epoxy coating shall be repaired following the "Guidelines for Inspection and Acceptance of Epoxy Coated Reinforcing Bars" by CRSI. A copy of these reports must be available at the jobsite for reference.

Accessories supporting epoxy coated bars or welded wire fabric shall be epoxy coated. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting a 300 lb load without damage or permanent distortion.

SAWING & SEALING JOINTS IN ASPHALT PAVEMENT AT BRIDGES

The work under this heading shall include the saw cutting of asphalt pavement over the bridge abutments as shown on the plans and as directed by the Engineer.

Saw cut equipment shall be approved by the Engineer prior to commencing work.

The hot-poured joint sealer shall be placed immediately after the joint has been saw cut and cleaned of all dust and debris. The hot-poured joint sealer shall meet the material specifications of M3.05.0.

ITEM 995.01 (Continued)**DRILLING AND GROUTING DOWELS**

The work to be done under these Items shall consist of drilling and grouting holes in the existing concrete or stone masonry for steel reinforcing dowels for construction of the proposed abutment, as shown on the Plans, or as directed by the Engineer. The dowel embedment must be adequate to fully develop 125% of the yield strength of the bar. The embedment length, the method and equipment used to drill the dowel holes, and the diameter of the drilled hole shall at a minimum conform to the recommendations of the manufacturer and be submitted to the Engineer for approval.

Materials

The grout to be used for these dowels shall meet the requirements of:

1. "Garonite HD" as manufactured by Garon Products, Incorporated of Wall, New Jersey.
2. "FX-228", as manufactured by Fox Industries, Incorporated of Baltimore, Maryland.
3. "Five Star Grout", as manufactured by U.S. Grout Corp. of Fairfield, Connecticut.
4. An approved equal. A copy of MassDOT's Approved Products List may be consulted and is available on its website.

Epoxy, vinyl or polyester resin adhesives shall not be utilized.

Reinforcing steel dowels shall meet the requirements of AASHTO M 31 Grade 60. All reinforcing steel dowels shall be epoxy coated in accordance with AASHTO M 284 or shall be galvanized in accordance with ASTM A767. Reinforcing steel dowels shall be incidental to the work under this Item.

Construction Methods

All dowel holes shall be air drilled provided that the minimum edge distance of 10 inches is observed. Should, in the Engineer's opinion, air drilling be inappropriate due to questionable strength of the existing granite/concrete or insufficient edge distance, the dowel holes shall be diamond core drilled. The inner surfaces of the diamond core drilled dowel holes shall be subject to the approval of the Engineer. The diameter of the drilled dowel holes shall be in accordance with the recommendations of the grout manufacturer. The holes shall be blown clear of any debris and shall have the approval of the Engineer prior to the placement of any grout material. The drilling operation shall be performed without damage to any portion of the existing structure that is to remain in place. Any damage to any portion of the existing structure that is to remain in place shall be repaired to a condition equal to or better than that existing prior to the beginning of the Contractor's operations and shall be repaired at the Contractor's expense.

The Contractor shall strictly follow the recommendations of the manufacturer for mixing and placing the grout material prior to the placement of the dowel. The Contractor shall adhere to the recommendations of the manufacturer regarding minimum and maximum temperatures while placing the grout. Any excessive grout around the hole after placement of the dowel shall be struck off smooth while the grout is still fresh.

ITEM 995.01 (Continued)

The Contractor shall perform a minimum of two (2) tests of the dowels for capacity in tension in existing abutments and retaining walls encountered on site. The test shall be performed in the presence of and to the satisfaction of the Engineer. The testing, including the necessary material and equipment to perform the test, is incidental to the work under this Item. The pullout force shall correspond to 90% of the yield strength of the bar. If the test bar pulls out or if the concrete utilized in the test shows signs of fracture, the Contractor shall adjust the hole diameter, embedment length, and/or grout material to meet this requirement. The method of applying the tension load to the dowels shall conform to ASTM E488. Details of the test procedure, materials, and equipment shall be submitted to the Engineer for review and approval prior to commencement of the test. Dowels shall not be ordered until the embedment lengths have been approved by the Engineer.

The Contractor shall arrange with the material's manufacturer or distributor to have the services of a competent field representative at the work site prior to any drilling of the proposed dowel holes to instruct the work crews in proper dowel installation procedures. The field representative shall remain at the job site after work commences and continue to instruct until the representative, the Contractor, and Engineer are satisfied that the crew has mastered the technique of installing the dowels successfully. The representative shall make periodic visits to the project as the work progresses and shall confer on each visit with the Contractor, Inspector and/or Engineer. The manufacturer's field representative must be fully qualified to perform the work and shall be subject to the approval of the Engineer.

The Contractor shall be completely responsible for the expense of the service of the required field representative and the contract unit price shall be considered full compensation for all costs in connection therewith.

LAMINATED ELASTOMERIC BEARING W/O ANCHOR BOLTS (0-50K)

The work under this heading shall include the fabricating and installation of the laminated elastomeric bearings. The bearings shall conform to the requirements of M9.14.5. The quantities listed below in the Schedule of Basis for Partial Payment only include the number of bearings required for construction and do not include the additional bearings required for conformance and destructive testing as outlined in M9.14.5.

STRUCTURAL STEEL M270 GRADE 50W

The work under this heading shall conform to the provisions of Section 960 of the Standard Specification and the following:

All structural steel shall conform to the requirements of M8.05.0 for AASHTO M270, Grade 50W.

MEMBRANE WATERPROOFING FOR BRIDGE DECKS – SPRAY APPLIED

The work under this heading shall conform to applicable sections of Section 965 of the Standard Specifications and the following:

ITEM 995.01 (Continued)

The work to be performed shall consist of the furnishing and application of an approved cold liquid spray applied, seamless methylemethacrylate or polyurea membrane system and all concrete surface preparation work necessary to install the membrane system. The membrane system shall consist of the primer, the membrane, aggregated keycoat layer, and tack coat.

General

Membrane application shall be in accordance with the manufacturer's instructions. The Manufacturer's representative shall be present during the entire application and shall oversee surface preparation, installation and quality control testing. The handling, mixing, and addition of membrane components shall be performed in a safe manner to achieve the desired results in accordance with the manufacturer's recommendations. All open flames and spark producing equipment shall be removed from the work area prior to commencement of application. No smoking signs shall be posted at the entrances to the work. The Applicator shall be responsible for the protection of equipment and adjacent areas from overspray or other contamination.

The Contractor and the Applicator shall agree upon a schedule for coordination between trades working in the areas that are to receive the membrane system. Before beginning the application, the Contractor shall schedule and conduct a meeting at the site to review the approved submittals, and other pertinent matters related to the application including the schedule for coordination between trades. Present, as a minimum, shall be the Contractor, the Applicator, the Manufacturer's Field Representative and the Engineer.

All components of the membrane system shall be delivered to the site in the manufacturer's original packaging, clearly identified with the products type and batch number. The Contractor shall provide the Applicator with a storage area for all components. The area shall be cool, dry, out of direct sunlight, and complies with relevant health and safety regulations. Copies of material safety data sheets for all components shall be kept on site at the Contractor's field office.

Only products pre-approved by MassDOT will be accepted for use. Product approval shall require the demonstration by the manufacturer that the membrane system meets the material specifications and that the entire membrane system is designed and tested as waterproofing for use on bridge deck applications. The manufacturer shall demonstrate through testing prior to approval that the system meets material properties and performance requirements stated herein.

Submittals

The Contractor shall submit to the Engineer for approval the membrane system material specifications, installation procedure, application equipment and testing as well as product performance data, storage and protection instructions, handling and mixing instructions, material safety data sheets (MSDS) for all components. An 8 inch square sample of the proposed membrane representing in color, texture and thickness satisfactory field application shall be provided to the Engineer. All submittals shall be certified to be in conformance with the manufacturer's instructions.

ITEM 995.01 (Continued)Materials

The waterproofing membrane shall consist of a one or two coat rapid curing liquid spray applied methylmethacrylate or polyurea for a total minimum membrane thickness of 100 mils measured over peaks. The membrane shall easily accommodate the need for day joints and patch repairs. The membrane shall be able to bridge live cracks up to 1/8 inch in width and shall conform to the following requirements:

Property	Test	Requirements
Minimum Thickness		100 mils minimum measured over peaks
Water Vapor Transmission	ASTM E 96-00 Method A	$< 1.66 \times 10^{-3}$ lb/ft ² /day

Adhesion to concrete	ASTM D 4541	100 psi minimum. Failure in concrete will require additional concrete preparation
Tensile	ASTM D 638 Method A, Die C	> 1,700 psi
Elongation at Break	ASTM D 638 Method A, Die C	130 % Typical
Crack Bridging	ASTM C 836- 00	Pass 10 cycles at - 14.8° F no failure at 1/8 inch

The primer shall promote adhesion of the membrane to the concrete surface. The chemical composition of the primer, membrane, aggregate keycoat and tack coat that make up the membrane system shall conform to the manufacturer's specifications for the material and shall be approved by the manufacture as being compatible for use with the specified membrane. Cleaning solvents shall also be as approved by the manufacturer for use with the membrane.

Applicator

The membrane waterproofing system shall be applied by an Applicator who is approved by the membrane system manufacturer. The Applicator installing the membrane shall have at least 2 years of experience on membrane installation with applicator certified by the membrane manufacturer. The Engineer shall receive manufacturer's written approval of the Applicator's qualifications at least seven days prior to the application of any system component. This approval shall apply only to the named individuals performing the application.

ITEM 995.01 (Continued)**Application Procedure**

The application procedure shall consist of concrete surface preparation, applying primer, applying membrane, applying aggregated keycoat layer, applying Polymer Modified tack coat.

Special attention shall be paid to the bridge deck surface preparation prior to the membrane system application. A representative from the membrane manufacturing company shall be present for the entire duration of the membrane application. The manufacturer's representative shall be responsible for the field testing, required documentation and reporting.

The membrane system shall not be applied in either wet, damp or foggy weather, or when the ambient temperature is 40° F or below or is forecast to fall below 40° F during the application period.

The membrane waterproofing on bridge decks shall not be placed until the Contractor is ready to follow within 24 hours with the first layer of Hot Mix Asphalt pavement; a longer period of time will be allowed only with the approval of the Engineer.

Where the areas to be waterproofed are bound by a vertical surface including, but not limited to, a curb or a wall, the membrane system shall be continued up the vertical as necessary. A neat finish with well-defined boundaries and straight edges shall be provided.

1. Concrete surface preparation: Concrete surfaces which are to be waterproofed shall be screeded to the true cross section, sounded and all spalls and depressions shall be repaired prior to the application of the prime coat. Depressions shall be filled to a smooth flush surface with 1:2 mortar (1 part cement to two parts sand) or an approved rapid setting patching mortar that is compatible with the waterproofing system. Other surfaces shall be trimmed free of rough spots, projections or other defects which might cause puncture of the membrane so that the surface profile of the prepared concrete surface shall not exceed a ¼ inch amplitude, peak to valley.

The use of resin or wax-based deck curing membranes is not acceptable.

Immediately prior to the application of the primer, the concrete to which the membrane is to be applied shall be cleaned of all existing bond inhibiting materials using an abrasive blast. Dust or loose particles shall be removed using clean, dry oil-free compressed air or industrial vacuums. The surface preparation shall insure that the concrete surface shall be free of bituminous product, surface laitance, oil staining, soiling, and dust and produce a clean dry surface.

Random tests for adequate tensile bond strength of the membrane shall be conducted on the concrete in accordance with ASTM D 4541 using the membrane manufacturer's primer and membrane to achieve minimum bond strength of 100 psi with failure in the concrete. Additional preparation of the concrete shall be required if a bond strength of a least 100 psi is not demonstrated in the concrete-membrane interface.

ITEM 995.01 (Continued)

2. Applying Primer: The primer shall only be applied when the temperature of the concrete deck surface exceeds the dew point and when the concrete deck surface has moisture content of 5.5% or less as confirmed by a portable electronic surface moisture meter supplied by the Contractor. The primer shall be applied to ensure full coverage. The concrete to which the membrane is to be applied shall have cured a minimum of 7 days prior to the application of the primer. A second coat of primer shall be required if first coat of primer is absorbed by the concrete. The primer shall be over sprayed with the membrane for up to the manufacture allowed re-coat drying time but in no case it shall exceed 24 hours. Beyond this period, the surface shall be prepared again and re-primed following the manufacturer's recommendations prior to membrane application.

3. Applying Membrane: The waterproofing membrane shall be applied in a methodical manner. The Applicator shall follow the approved mixing and application procedure. Unless approved by the Engineer, the membrane shall be spray applied, with the mixing of the two components taking place at the nozzle, and shall be applied to the primed deck in accordance with the manufacturer's instructions. The spray equipment shall be computer controlled, monitoring mixing ratios and quantities applied, and the latter allowing coverage rates to be checked. Following the application of membrane system and before holiday testing, the cured surface shall be visually inspected. If any defects or pinholes are found, an appropriate quantity of membrane shall be mixed by hand and repairs effected by touch-in with a putty-knife hand tool, ensuring in all cases that the thickness of the repair is sufficient to bring the area up to the specified thickness and that the thickness of the repair patch is a minimum 100 mils.

4. Applying Aggregated Keycoat: Following the membrane application, a layer of resin, compatible with the membrane shall be spray applied to a thickness of 30 to 40 mils into which a crushed basalt aggregate approved by the membrane manufacturer shall be broadcast ensuring minimum 80% coverage.

5. Applying Polymer modified Tack Coat: The manufacturer's tack coat shall be applied in accordance with the membrane manufacturer's recommendations after a minimum of three hours from initial membrane application. Polymer modified tack coat shall be heated and melted in a kettle at a temperature between 375°F-400°F and applied at a coverage rate of between 25-35 Square Feet/Gallon. The Tack Coat shall be allowed to cool for a minimum of 1 hour prior to the application of the hot rolled asphalt.

During paving, a light soap spray should be applied to the paving equipment wheels to prevent removal of the tack coat.

ITEM 995.01 (Continued)

6. Repairs: If an area of membrane requires repair or if the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the membrane system. The damaged area shall be cut back to sound materials and wiped with a solvent up to a width of at least 6 inches beyond the periphery of the damaged area, removing contaminants. The concrete shall be primed as necessary, followed by the application of the membrane. A continuous layer shall be obtained over the concrete with a 6 inch overlap onto the existing membrane. The solvent shall be as approved by the membrane waterproofing manufacturer. Repairs shall comply with the manufacturer's guidelines for any over-coating times.

Where the membrane is to be joined to existing cured material and at day joints, the new application shall overlap the existing membrane/day joint by at least 4 inch. The existing membrane/day joint shall be cleaned of all contamination including tack coat material or dirt to an edge distance of a least 6 inch and wiped with a solvent as approved by the membrane waterproofing manufacturer.

7. Field Quality Control: The following tests shall be conducted by the manufacturer's representative and recorded on a test report form to be submitted to the Engineer. All test reports shall be submitted to the Engineer within 5 working days of the test completion.

- a. Temperature and Moisture: Concrete deck temperature and dew point readings shall be taken prior to commencing the primer application. Air temperature shall be recorded every 4 hours during the application process.
- b. Film Thickness: Wet film thickness shall be checked every 300 square feet using a gauge pin or standard comb type thickness gauge or a magnetic gauge. Film thickness checks shall be carried throughout the application process. During the Final Review, the cured membrane film thickness shall be checked by a dial thickness gauge.
- c. Pin Hole/Holidays: The entire surface of the membrane shall be holiday tested in accordance with ASTM D 4787 using an approved holiday tester. All holidays shall be located, marked for repair, documented, and repaired in accordance with the approved repair procedure. The holiday testing equipment shall be independently calibrated with valid certification. The spark tester shall be adjusted to suit the conductivity of the in-place concrete substrate prior to testing in accordance with ASTM D-4787. Tester certification shall be provided to the Engineer prior to commencing the application process. The Engineer shall oversee the holiday testing.
- d. Adhesion Tensile Bond: Random tests for adequate tensile bond strength shall be conducted in accordance with ASTM D 4541 using the membrane manufacture's primer and membrane. The test shall be conducted using the membrane as the adhesive to the test dolly. Minimum bond strength of 100 psi will be required for acceptance. Failure in the concrete will require additional surface preparation of the concrete. Tester Model 106, or approved similar equipment shall be used. A frequency of 1 test per 5,000 square feet or fraction thereof shall be conducted. Areas smaller than 5,000 square feet shall receive a minimum of 3 tests.

ITEM 995.01 (Continued)

- e. Visual inspections shall be conducted throughout the application process. The Manufacturer's Field Representative shall take progress photos for incorporation with his final review report to the Engineer.

Final Review

The final review visual inspection shall be conducted jointly by the Applicator, Contractor, Manufacturer's Field Representative and Engineer. Irregularities or other items that do not meet the requirements of the Special Provisions and the Plans shall be addressed/repared at this time, at no additional cost to the MassDOT.

SCHEDULE OF BASIS FOR PARTIAL PAYMENTS

Within 10 days after the Notice To Proceed, the Contractor shall submit on his/her proposal form a schedule of unit prices for the major component Sub-Items that make up Item 995.01 as well as his/her total bridge structure LUMP SUM cost for the Bridge Structure No. C-09-001 (3FL).

The bridge structure LUMP SUM breakdown quantities provided in the proposal form are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the LUMP SUM contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 995.01 and no further compensation will be allowed.

The schedule on the proposal form applies only to Bridge Structure C-09-001 (3FL). Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

ITEM 995.01 (Continued)

<u>Sub-Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
482.31	Sawing & Sealing Joints in Asphalt Pavement at Bridges	110	FT		
901.	4000 psi, 1.5 IN, 565 Cement Concrete	520	CY		
904.	4000 psi, ¾ IN, 610 Cement Concrete	170	CY		
904.3	5000 psi, ¾ IN, 685 HP Cement Concrete	95	CY		
904.4	4000 psi, ¾ IN, 585 HP Cement Concrete	120	CY		
908.4	Cement Concrete Form Liner (Inset Architectural)	470	SY		
910.1	Steel Reinforcement for Structures – Epoxy Coated	98,000	LB		
910.4	Mechanical Reinforcing Bar Splicers	240	EA		
911.1	Shear Connectors	3,640	EA		
912.5	Drilled and Grouted #5 Dowels	120	EA		
922.1	Laminated Elastomeric Bearing w/o Anchor Bolts (0-50K)	36	EA		
960.1	Structural Steel – Coated Steel	1,100	LB		
960.4	Structural Steel M270 Grade 50W	116,000	LB		
965.2	Membrane Waterproofing for Bridge Decks – Spray Applied	2,850	SY		
966.	Waterproofing Protective Course	50	SY		
967.	Membrane Waterproofing	35	SY		
970.	Bituminous Damp-Proofing	285	SY		
975.4	Protective Screen Type II	180	FT		
975.5	Aluminum Handrail	90	FT		
Total Cost of Item 995.01=					

The above schedule applies only to the Bridge Structure C-09-001 (3FL). Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with MassDOT Standard Nomenclature.

<u>ITEM 996.01</u>	<u>WALL STRUCTURE, WALL NO. 1</u>	<u>LUMP SUM</u>
<u>ITEM 996.02</u>	<u>WALL STRUCTURE, WALL NO. 2</u>	<u>LUMP SUM</u>
<u>ITEM 996.03</u>	<u>WALL STRUCTURE, WALL NO. 3</u>	<u>LUMP SUM</u>
<u>ITEM 996.04</u>	<u>WALL STRUCTURE, WALL NO. 4</u>	<u>LUMP SUM</u>

The work under these items shall consist of the construction of steel “H-pile” and precast concrete panel retaining walls as specified herein and as indicated on the Plans. The work shall conform to the relevant provisions of Section 900 of the Standard Specifications.

The retaining walls shall consist of Steel “H-Piles” with precast concrete panels topped with a cast-in-place cement concrete barrier cap. Safety railings shall be installed along the top of the retaining walls, as indicated on the plans.

Soldier piles shall be installed through all material encountered to the depth required by design. Installation equipment shall be capable of drilling through boulders, and any other obstructions, encountered during installation.

The soldier pile and lagging walls are designed to be free draining and shall be constructed to conform to this intent. Anti-Graffiti protective coatings shall be applied to all exposed faces of concrete and steel surfaces under the permanent condition.

The supports for the soldier pile and lagging walls shall consist of a pre-augered drilled shaft with an embedded galvanized steel soldier pile. Once the soldier pile is placed in concrete in its augered hole and flowfill is placed above the concrete and set, the use of additional flow fill or nonformed concrete shall not be allowed. Timber lagging will be placed starting from the top and progressing to the bottom of the wall. A filter fabric will be attached to the lagging. Precast concrete panels will be installed and crushed stone will be used to fill the void between the panel and the lagging. A cast-in-place concrete cap will be placed on top of the wall. In many cases, the soldier pile and lagging walls will support a safety railing and fencing. These soldier pile and lagging walls shall be furnished complete in place in accordance with the lines, grades, dimensions and all appurtenances shown on the Contract Drawings, as directed herein, or as directed by the Engineer.

Soldier pile and lagging walls will be bonded for continuity by extending a continuous uncoated bar to connect the tops of all soldier piles within the cap.

The work under this item also includes all labor, materials and equipment for safety railings and fencing to be installed along the tops of the retaining walls.

These Items include all material and labor necessary to complete the work in accordance with the schedule of items included herein under Basis for Partial Payment and all other items that are part of the work for which payment is not provided for elsewhere. The unreinforced leveling pad shall be set on firm and level surface. Any foundation soil found to be unsuitable should be removed and replaced as directed and compacted with a vibratory compactor to provide a firm in-place foundation. The cost shall be incidental to price per cubic yard of concrete.

ITEMS 996.01 thru 996.04 (Continued)**SUBMITTALS**

- A. Working Drawings
1. Submit working drawings at least two (2) weeks before beginning excavation or installation of excavation support system and bracing.
- B. Additional Requirements for Working Drawings – Working drawings shall include the following:
1. Grades and strengths of all construction materials used.
 2. Full excavation depth.
 3. Depths below the main excavation to which the excavation support system will be installed if necessary.
 4. Method for installing wall.
 5. Method for attaching lagging.
 6. Method for attaching concrete cap beam.
 7. Architectural Form Liner
 8. Loads on the excavation support system for various stages of excavation.
 9. Anticipated equipment, traffic (and other surcharge) loads on adjacent ground during construction.
 10. Existing utility facilities, including underground and overhead utilities. After checking locations of utilities by field investigations, determine which affect or potentially may affect.
- C. Submit design calculations. All design calculations shall be performed, stamped, and sealed by a Professional Engineer registered in the Commonwealth of Massachusetts.
- D. Submit Plan of Actions to be implemented in the event any Response Value for deformation, as specified in the Table below, is reached.

TABLE – RESPONSE VALUES

Monitoring Type	Value
<u>Lateral Deflection of Earth Support Wall</u>	
Top of Pile	1.0%
Mid-Point of exposed Pile	0.5%
<u>Vertical Deflection of Earth Support Wall</u>	
Top of Pile	1/2 inch

ITEMS 996.01 thru 996.04 (Continued)**MATERIALS****Steel Piles:**

Steel piles shall conform to the requirements of AASHTO M183 Grade 36 and conform to the relevant provisions of Section 940 and 960 of the Standard Specifications. The pile shall be hot dipped galvanized in accordance with AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight).

Painting of the exposed face of the galvanized piles shall conform to the relevant provisions of Section M7, and these Special Provisions and to the color shown on the Plans or as directed.

Precast Concrete Panels:

The manufacturer of the panels should note that retaining walls 1, 2, 3 and 4 are approximately 400 feet; 550 feet; 500 feet and 80 feet long, respectively. It is the intent that the entire 1530 feet of wall have the same appearance. This shall be achieved by use of architectural form liners with a “dry laid stone” finish. The Contractor shall coordinate with the precast wall manufacturer and the Engineer to achieve this goal. The precast concrete panels shall be manufactured to the relevant provisions of Section 900 and Material Section M4 including but not limited to Subsection M4.02.14.

The architectural form liners shall be manufactured of thermoformed rigid polymer alloy sheets. The liners shall accommodate form pressures to a maximum 1000 psf.

The precast concrete panels shall be manufactured of air-entrained 5000 psi, 3/4 inch cement concrete, true to line, plane and dimensions shown on the Plans.

Steel Reinforcement for Structures – Epoxy Coated:

Steel reinforcement for concrete structures shall conform to the relevant provisions of Section 900 of the Standard Specifications. Reinforcing bars shall be deformed bars rolled from new billet steel conforming to the requirements of ASTM A615, Grade 60 and shall be epoxy coated. Epoxy coated reinforcing bars shall conform to AASHTO-M284.

Safety Railings:

Safety Railings shall be installed along the top of Retaining Wall Nos. 1 and 2 as detailed on the Plans. The work will be performed in accordance with the requirements of the AASHTO Standard Specifications for Highway Bridges, the Bridge Welding Code (ANSI/AASHTO/AWS D1.5) and these Special Provisions. All steel for main support posts, railing bars, base plates, anchor plates, attachment bars, and railing circles shall conform to the requirements of AASHTO M183 Grade 36 shall be hot-dip galvanized in accordance with ASTM A123.

ITEMS 996.01 thru 996.04 (Continued)

Steel Pipe for Guardrails shall conform to ASTM A500 Schedule 80 (Extra Strong), galvanized and supplied with end caps. All Steel for railing and all attachments shall be hot-dip galvanized in accordance with the requirements of AASHTO M111. The galvanizing bath shall contain nickel (0.05% to 0.09% by weight). All welding shall conform to latest edition of the AASHTO/AWS Bridge Welding Code (ANSI/AASHTO/AWS D1.5).

Paints shall conform to the requirements of Section M7 and the following: Epoxy Urethane coating system of an epoxy intermediate coat with an aliphatic urethane finish coat shall be selected from: Valspar, Ameron, Caboline, Koppers, or an approved equal. The color of finish coat is to be black (semi-gloss).

Fencing:

Chain Link Fencing shall be installed along the tops of retaining walls as detailed on the Plans. The fencing shall conform to the relevant provisions of Section 644. Galvanized pipe sleeves cast in concrete shall as shown on the Plans and shall be incidental to cast-in-place concrete cap (5000 psi - ¾ inch – 685 HP Cement Concrete).

Anti-Graffiti Compound

Anti-graffiti compound shall consist of an invisible surface barrier that will provide protection against graffiti to porous masonry surfaces. Manufacturer supplying the graffiti control treatment shall have been regularly engaged and specializing for the preceding ten (10) years in the formulation, manufacture and distribution of graffiti control products for masonry substrates.

The Contractor shall submit to the Engineer for approval a complete list of materials proposed for use, giving the manufacturer's name, product name and any necessary identification numbers for each item, and the manufacturer's data sheets and recommendations for installation including relevant limitations, safety factors, environmental precautions, and application rates

Bituminous Dampproofing:

5-inch wide waterstop and 2-foot wide filter fabric shall conform to relevant provisions of the Standard Specifications. Filter Fabric shall conform to the requirements of AASHTO M 288 for the intended application and to Type III Fabric in accordance with Subsection M9.50.0 of the Standard Specifications, and the Supplemental Specifications.

Expansion joints and expansion anchors shall conform to the relevant provisions of Section 900 of the Standard Specifications.

ITEMS 996.01 thru 996.04 (Continued)**CONSTRUCTION METHODS**

General Requirements

- A. Install the wall in accordance with the accepted working drawings, and in such a manner as to prevent movement, settlement, loss of ground, removal of fines from the adjacent ground, and damage to or movement of adjacent structures and utilities. This could include the use of drilling slurry during installation of soldier piles in predrilled holes to maintain stable drill holes and limit the loss of ground outside the drill hole.
- B. Perform work from track side of the proposed wall unless temporary easements have been granted to minimize adjacent property impacts. Heavy equipment shall be placed on the track side of the proposed wall.
- C. Perform field welding by certified welders in accordance with American Welding Society Standards AWS D 1.1, "Structural Welding Code - Steel."
- D. Implement the Plan of Actions as submitted under Paragraph 1.3D, if Response Values as specified in the Response Value Table are reached.
- E. Borings indicate below ground obstructions may be encountered. Such obstructions may include, but are not necessarily limited to, boulders and various other demolition and construction debris.
- F. Temporary casings used for pre-drilling holes for soldier piles shall be installed where specified on the Contract Drawings to top weathered bedrock, as a minimum, using rotary drilling techniques over their full depth to limit potential vibration damage to adjacent structures and facilities. Potential vibration damage could result if the piles or casing were installed using driving or vibratory methods.
- G. Protection of Existing Adjacent Structures
 - 1. The Contractor shall repair all damage to adjacent properties and restore the surfaces and finishes to the original state.
 - 2. If in the opinion of the Engineer the integrity of the adjacent railroad tracks, bridge, buildings, structures, or paved areas are jeopardized due to movement, the Contractor shall immediately discontinue further excavation in the affected area and implement accepted Plan of Action to mitigate further movement. Mitigating measures shall remain in effect until such time that the Engineer evaluates the impact on the structure and may direct the Contractor to perform any remedial work. The Contractor shall submit proposed remedial measures to the Geotechnical Engineer for review and approval. Submittals shall include methods and names of subcontractors. The Contractor shall proceed with remedial work upon acceptance by the Engineer. Mitigating measures shall be at no additional cost.

Steel Piles:

The piles shall be set taking into account anticipated deflection at the top of wall, true to line and grade as shown on the Plans, and/or as directed. Pile shall be set by use of a temporary jig to ensure that pile spacing and plumbness remain true. The temporary jig will remain in place until concrete has set. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 2% of the height of the wall along its back slope and 1% of the height along its front slope. Temporary supports shall support "H-piles" for at least 5 days before concrete panel installation begins.

ITEMS 996.01 thru 996.04 (Continued)

The “H-piles” shall be installed by placing them in 24 inch predrilled or preaugered holes placed 8 feet on centers. Predrilled or pre-augered holes shall be protected when necessary against cave-ins, displacement of surrounding soil and for retention of ground water by means of temporary steel casing or use of slurry subject to approval by the Engineer. Predrilling /preaugering shall following the relevant provisions of Section 945.

The “H-piles” shall be installed in the holes and shall be encased in 3000 psi lean concrete. A portion of the lean concrete shall be excavated/removed in order that the bottom of wall elevation/excavation can be met.

Precast Concrete Panels

Precast concrete panels shall be placed so that their final position is vertical as shown on the Plans. For erection, panels are handled by means of lifting devices connected to the upper edge of the panel. Panels should be placed in successive horizontal lifts in the sequence shown on the approved Shop Drawings as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in position by means of temporary wedges or bracing according to the wall supplier’s recommendations. Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed $\frac{3}{4}$ inches when measured with a 10 foot long straight edge. During construction, the maximum allowable offset in any panel joint shall be $\frac{3}{4}$ inch. The overall vertical tolerance of the wall (top to bottom) shall not exceed $\frac{1}{2}$ inch per 10 feet of wall height.

The base of the precast wall panels shall be set on a base leveling pad, set to the lines and grades shown on the drawings, to a minimum thickness of 6 inches and extend laterally a minimum of 6 inches in front and behind the wall panel. Base leveling pad shall be prepared to insure full contact to the base surface of the precast concrete wall units.

Safety Railings:

The safety railing main support posts shall be bolted to the retaining wall such that they rise within a tolerance of one-half (0.5) degree from the vertical. The railings shall be delivered to the site, shop assembled in two components. The main support posts shall be delivered as one unit galvanized and painted, and shall consists of; railing main posts, main post base plate, guardrail sleeve, and attachment bars as shown on the Plans. The railing panels shall be delivered as on unit galvanized and painted, and shall consist of; bottom railing bar, intermediate railing bar, top railing bar, guardrail, and railing bars as shown on the Plans.

All railing steel shall be hot-dip galvanized having a minimum dry film thickness of 3 mils and shall receive one full shop applied intermediate coat of epoxy and one full shop applied finish coat of aliphatic urethane, unless otherwise noted. Each coat shall have a dry film thickness of 5 to 8 mils. Color of finish is to be black. Paint shall be applied with satisfactory airless spray machines in accordance with the paint manufacturer’s instructions and the applicable provisions of SSPC-PA-1. Any damage to the paint system during shipment or handling shall be repaired as per the paint manufacturer’s recommendations.

ITEMS 996.01 thru 996.04 (Continued)

The Contractor shall submit the selected manufacturer's technical data sheets, safety data, specific application instructions, and recommended procedures for all coats for approval by the Engineer.

Painting procedures shall be in accordance with the applicable requirements for Subsection 960.63, Painting, the paint manufacturer's recommendations and conforming to ASTM D6386-99. All coatings shall be in compliance with 310 CMR Section 7.0 and 7.18 of the Massachusetts Air Pollution Control Regulations.

Anti-Graffiti Compound

The treatment may be applied using low-pressure spray, brush, or roller. The surface to be treated shall be prepared as recommended by the product manufacturer prior to the application of the treatment. All activities shall be in compliance with relevant local codes and governmental regulations. Coatings shall be in compliance with the latest Volatile Organic Compound (VOC) state requirements.

Manufacturer supplying the graffiti control treatment shall have been regularly engaged and specializing for the preceding ten (10) years in the formulation, manufacture and distribution of graffiti control products for masonry substrates. A representative of the manufacturer of the graffiti control treatment shall be present during preparation and application of all test areas.

Testing shall be conducted on an unobtrusive location on representative conditions. Test will include cleaning and surface preparation proposed for the project, followed by the application of the treatment. The Engineer shall approve all test areas and application procedures prior to beginning full-scale treatment. Adjacent surfaces not to be treated shall be tested for possible detrimental effect or aesthetic alteration created by exposure to the treatment and shall be protected as determined necessary.

Materials shall be delivered to the site in the manufacturer's original, unopened containers bearing the manufacturer's label. The Contractor shall store and handle the materials in accordance with the manufacturer's recommendations.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Separate measurement and payment will not be made for the work under these items, but all costs in connection therefore shall be included in the Contract LUMP SUM Price for ITEM NO. 996.01, WALL STRUCTURE, WALL NO. 1; ITEM NO. 996.02, WALL STRUCTURE, WALL NO. 2; ITEM NO. 996.03, WALL STRUCTURE NO. 3; and ITEM NO. 996.04, WALL STRUCTURE, WALL NO. 4.

The LUMP SUM prices shall include all materials, labor, tools and equipment incidental and necessary for the installation, complete in place.

ITEMS 996.01 thru 996.04 (Continued)

Within ten (10) days after the receipt of the Notice To Proceed, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of Quantities and Unit Prices for the major components of the Wall Structures as listed below.

The wall structure LUMP SUM breakdown quantities provided below are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the LUMP SUM contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item Nos., 996.01, 996.02, 996.03 and 996.04 and no further compensation will be allowed.

Wall Structure, Wall No. 1

<u>Sub-Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit/Unit Price</u>	<u>Total</u>
	Precast Concrete Panels		SF	
	5000 psi, 3/4 in., 685HP Cement Concrete		CY	
	4000 psi, 3/8 in., 610 Cement Concrete		CY	
	3000 psi, 3/8 in., 510 Cement Concrete		CY	
	Steel Reinforcement for Structures Epoxy Coated		LB	
	Bituminous Damp-proofing		SY	
	4'-0" High Safety Railing		FT	
	120-Inch High Black Vinyl Coated Chain Link Fence		FT	
	Steel Pile HP24x279 (Galvanized and Painted)		FT	
	Anti-Graffiti Coating		SY	
Total Cost of Item 996.01 =				

Wall Structure, Wall No. 2

<u>Sub-Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit/Unit Price</u>	<u>Total</u>
	Precast Concrete Panels		SF	
	5000 psi, 3/4 in., 685HP Cement Concrete		CY	
	4000 psi, 3/8 in., 610 Cement Concrete		CY	
	3000 psi, 3/8 in., 510 Cement Concrete		CY	
	Steel Reinforcement for Structures Epoxy Coated		LB	
	Bituminous Damp-proofing		SY	
	120-Inch High Black Vinyl Coated Chain Link Fence		FT	
	Steel Pile HP24x207 (Galvanized and Painted)		FT	
	Steel Pile HP24x279 (Galvanized and Painted)		FT	
	Anti-Graffiti Coating		SY	
Total Cost of Item 996.02 =				

ITEMS 996.01 thru 996.04 (Continued)**Wall Structure, Wall No. 3**

<u>Sub-Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit/Unit Price</u>	<u>Total</u>
	Precast Concrete Panels		SF	
	5000 psi, 3/4 in., 685HP Cement Concrete		CY	
	4000 psi, 3/8 in., 610 Cement Concrete		CY	
	3000 psi, 3/8 in., 510 Cement Concrete		CY	
	Steel Reinforcement for Structures Epoxy Coated		LB	
	Bituminous Damp-proofing		SY	
	48-Inch High Black Vinyl Coated Chain Link Fence		FT	
	Steel Pile HP24x207 (Galvanized and Painted)		FT	
	Anti-Graffiti Coating		SY	
Total Cost of Item 996.03 =				

Wall Structure, Wall No. 4

<u>Sub-Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit/Unit Price</u>	<u>Total</u>
	Precast Concrete Panels		SF	
	5000 psi, 3/4 in., 685HP Cement Concrete		CY	
	4000 psi, 3/8 in., 610 Cement Concrete		CY	
	3000 psi, 3/8 in., 510 Cement Concrete		CY	
	Steel Reinforcement for Structures Epoxy Coated		LB	
	Bituminous Damp-proofing		SY	
	48-Inch High Black Vinyl Coated Chain Link Fence		FT	
	Steel Pile HP24x207 (Galvanized and Painted)		FT	
	Anti-Graffiti Coating		SY	
Total Cost of Item 996.03 =				

The above schedule applies only to the Retaining Wall Structures. Payment for similar materials and construction at locations other than at these structures shall not be included under this Item.

*** END OF SECTION ***